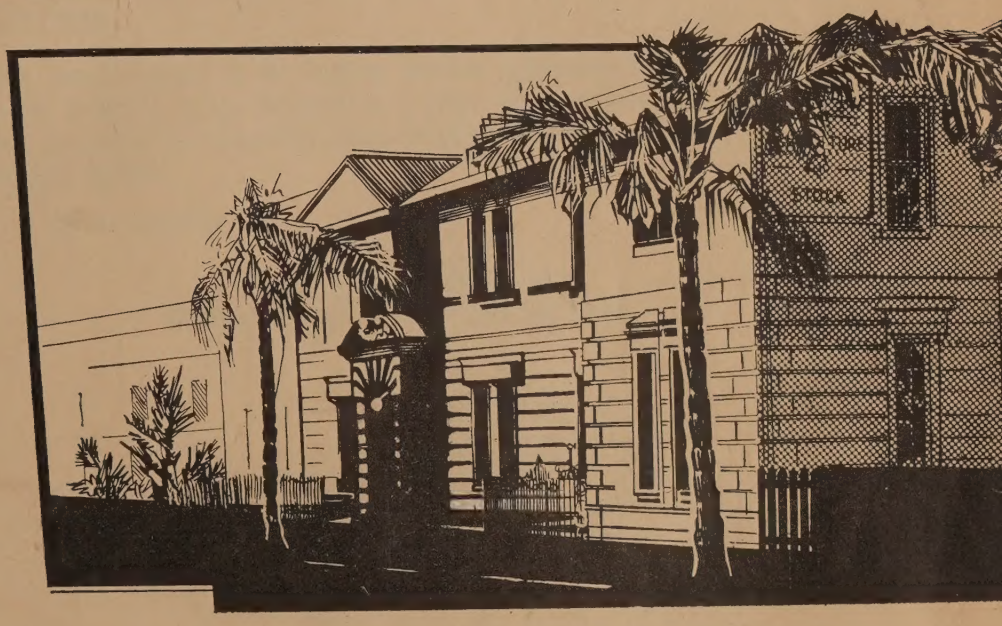
Department of Agriculture and Stock

1959—60



Annual Report . . .

N.S.R.
RAL

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A. 48—1960

COMMONWEALTH MYCOLOGICAL INSTITUTE
17 FEB 1961

To the Honourable the Minister for Agriculture and Forestry

Dear Sir,

I have the honour to submit herewith the Annual Report of the Department of Agriculture and Stock for the year ended June 30, 1960.

An overall review of the various primary industries and the major activities of the Department is given first. A more detailed account of the operations of the various Branches of the Department follows.

Yours faithfully,

W. A. T. SUMMERVILLE,
Director-General of Agriculture and Stock.

ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1960

MINISTER FOR AGRICULTURE AND FORESTRY .. Hon. O. O. Madsen, M.L.A.

CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—

Director-General and Under Secretary .. .. W. A. T. Summerville, D.Sc.
Deputy Director-General .. .. W. Webster, B.V.Sc.
Assistant Under Secretary .. .. H. Barnes.
Special Administration Officer .. .. C. L. Harris, A.A.S.A.
Officer in Charge, Information Services .. .. C. W. Winders, B.Sc.Agr.
Accountant .. .. E. C. R. Sadler, A.A.U.Q.

DIVISION OF PLANT INDUSTRY—

Director of the Division .. .. W. J. S. Sloan, M.Sc.Agr.

Agriculture Branch—

Director of Agriculture .. .. L. G. Miles, B.Sc.Agr., Ph.D.

Horticulture Branch—

Director of Horticulture .. .. S. A. Trout, M.Sc., Ph.D., F.R.A.C.I.

Regional Experiment Stations Branch—

Director of Regional Experiment Stations .. .. W. J. Cartmill, M.Sc., A.R.A.C.I.

Science Branch—

Sections of Botany (S. L. Everist, B.Sc., Government Botanist); Entomology (W. A. McDougall, D.Sc., Government Entomologist); and Plant Pathology (J. H. Simmonds, M.B.E., M.Sc., Government Plant Pathologist).

Chemical Laboratory—

Agricultural Chemist .. .. C. R. von Stieglitz, F.R.A.C.I.

DIVISION OF ANIMAL INDUSTRY—

Director of the Division .. .. A. L. Clay, B.V.Sc.
Assistant Director .. .. C. R. Mulhearn, B.V.Sc.

Veterinary Services Branch—

Director of Veterinary Services .. .. .. C. R. Mulhearn, B.V.Sc.

Pathology Branch—

Director .. .. L. G. Newton, B.V.Sc.

Biochemical Branch—

Biochemist .. .. J. M. Harvey, D.Sc., A.R.A.C.I.

Husbandry Research Branch—

Director of Husbandry Research .. .. .. J. W. Ryley, B.V.Sc.

Sheep and Wool Branch—

Director of Sheep Husbandry .. .. A. T. Bell, B.V.Sc.

Cattle Husbandry Branch—

Director of Cattle Husbandry .. .. .. D. N. Sutherland, B.V.Sc.

Pig and Poultry Branch—

Sections of Pig Husbandry (F. Bostock, Senior Pig Husbandry Officer); and Poultry Husbandry (F. N. J. Milne, B.Sc., Senior Poultry Husbandry Officer).

DIVISION OF DAIRYING—

Director of Dairying .. .. E. B. Rice, Dip.Ind.Chem.

Research Branch—

Director of Research .. .. L. E. Nichols, B.Sc.Agr., A.R.A.C.I.

Field Services Branch—

Director of Field Services .. .. F. C. Coleman, Q.D.D.

DIVISION OF MARKETING—

Director of Marketing .. .. H. S. Hunter.

Marketing Branch—

Director of Marketing .. .. H. S. Hunter.
Assistant Director of Marketing .. .. .. A. A. Ross, M.Agr.Sc.

Economics Research Branch—

Director of Economic Services .. .. C. H. P. Defries, H.D.A., B.Com., A.F.I.A.

Standards Branch—

Standards Officer .. .. A. C. Peel, Dip.Ind.Chem.

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REPORT OF THE DEPARTMENT OF AGRICULTURE AND STOCK FOR THE YEAR 1959-60

TO THE HONOURABLE THE MINISTER FOR AGRICULTURE AND FORESTRY

GENERAL REVIEW

The general seasonal picture for 1959-60 was marked by considerable variation throughout the State. An unusual feature was the partial failure of the monsoonal rains to reach the south-eastern area.

Good rains fell in the south-eastern agricultural and dairying areas and on the Far North Coast in July, 1959, but rainfall over the rest of the State was below normal. Grazing lands were still in fair condition except in the far south-west. August was a very dry month except on the Far North Coast, and most agricultural and pastoral areas were in need of rain by the end of the month. There was little improvement in the grazing districts during September, but good rains were received in the south-east and on the Far North Coast. Good rains fell in October in the south-east and some fair falls were recorded in the south-west. November rainfall in the south-east was well above normal, with some flooding, but the western areas had a dry month and rainfall in most of North Queensland was also below normal. Above-normal rainfall was recorded during December over all but the western and far northern areas.

The new year was ushered in by a hot, dry month which set back many summer plantings. The position was retrieved to some extent by good falls over most of the State in February, with the drought-stricken areas of the south-west participating. Conditions deteriorated in March, April and May, rainfall being below normal in most parts until late in May, when rain fell in most districts. June was a dry month, and the net result was that for the first half of 1960 the greater part of the State received from 10 per cent. below normal rainfall in northern districts to 35 per cent. below normal in south-eastern districts. May and June were particularly cold months and widespread severe frosts were experienced.

TRADE CONDITIONS

Total Australian exports in 1959-60 showed an increase from £810m. to £936m., one of the highest figures on record. Encouraged by the easing of licensing restrictions, imports increased by £150m. to £946m., resulting in a net trading deficit of £10m. The increase in exports was mainly the result of a rise of £92m. in the value of wool and sheepskins and of £25m. in wheat and flour.

Industrial and economic activity continued to increase in the U.S.A., United Kingdom and Western Europe. Of special importance to Australia was the increased activity in the wool textile industries of the main consuming countries. Apart from better prices, the wool clip was also bigger.

Figure 1 indicates the importance of wool in the export trade.

Higher export returns from dairy products also contributed to the larger export earnings, while the United States continued to take large quantities of manufacturing beef and mutton at prices which were still attractive, although below the high levels of 1958-59.

Competition on overseas markets is becoming much more intensive, and this, together with the effects of agricultural policies of other countries, underlines the need for long-range research, and for marketing and sales promotion plans. Our future marketing policies could well be influenced by the formation of regional trading blocks.

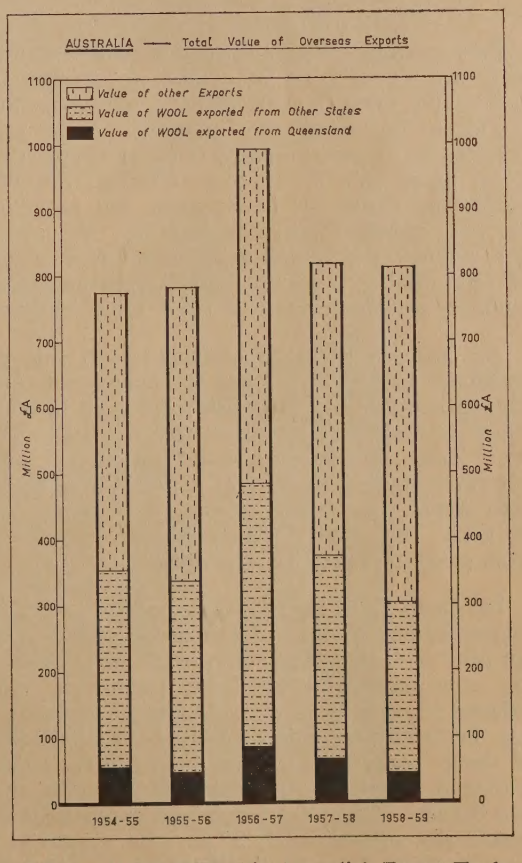


Fig. 1.—Value of Wool in Australia's Export Trade

SHEEP INDUSTRY

The patchy nature of the rainfall in the pastoral districts during 1959-60 resulted in mixed conditions for sheep raisers, with continuation of mulga feeding being necessary on some south-western properties throughout the year. Pasture conditions at the end of June, 1960, were good to fair in all areas other than west of St. George and including parts of the Charleville and Cunnamulla areas, where mulga was still being fed on some properties.

For the 1959-60 period, Queensland's total sale of 793,696 bales of wool realised £59·4 millions. The amount of wool sold showed an increase of 68,498 bales, or 9·4 per cent., on the previous year's total, and the financial return was £12 million more, representing an increase of 25·6 per cent.

Overall wool prices for the series of 12 Brisbane auction sales for 1959-60 averaged 13·6 per cent. higher than values for 1958-59. Below is shown the range of high and low average prices per lb. greasy per sale for the two years, and a general average for the series in each year—

	1958–59 (*d.*)	1959–60 (*d.*)
Highest average price at any sale	56·96	64·75
Lowest average price at any sale	45·16	51·05
General average for year ..	50·37	57·22

Thus the market recovered to some extent from the very low values of the previous year, but in spite of the encouraging start to the series with an average price of 64·75d. per lb., there was a general trend to lower values throughout the series, and the average price for the final sales was 51·05d.

Present wool values persist at a somewhat low level when considered in relation to production costs, and there is still anxiety regarding the economic future of the industry. This was reflected by a general timidity in buyers' approach, when many sale sheep were offering, towards purchasing sheep for replacement and breeding for wool-growing and store purposes. An abortive summer monsoonal rain season over much of Queensland's sheep country aggravated this tendency towards caution in stock replenishment.

An increase in the manufacture and sale of synthetic clothing throughout the main wool consuming countries in the world continued to constitute formidable competition to the wool industry. Table 1 compares world production and current estimated capacity of non-cellulosic fibres with world production of wool over a number of years, including those in which competition from synthetic fibres has intensified.

Fat lamb production in Queensland is minor in importance to the wool industry. Only 1·9 per cent. of Queensland's total of 22 million sheep are concerned with fat lamb production, the balance being wool-growing Merinos. Nevertheless, fat lamb production figures, both in number of sheep concerned and in the numbers being marketed. have shown notable increases in the past decade. Of lambs slaughtered at Queensland meatworks, approximately 25 per cent. are derived from northern New South Wales areas. Almost

TABLE 1

World Production of Fibres

Year	Non-cellulosic Fibres	Wool
	(m. lb.)	(m. lb. clean)
1934–38 (average) ..	..	2,024
1946–47	..	2,127
1947–48	..	2,100
1948–49	..	2,185
1949–50	..	2,253
1950–51	..	2,307
1951–52	..	2,357
1952–53	..	2,551
1953–54	..	2,568
1954–55	430	2,625
1955–56	585	2,780
1956–57	680	2,933
1957–58	903	2,876
1958–59	1,263 (estimated)	3,032
1959–60	1,756 (estimated)	3,165

(Source: Bureau of Agricultural Economics)

the whole of this State's slaughter goes to local consumption. There has, however, been a steady increase in the numbers of lambs slaughtered at Queensland meatworks from 91,544 in 1953-54 to an estimated 270,000 in 1959-60.

The problems of sheep pastures in the north-west, central-west and south-west have been receiving attention. Nursery plots of pasture species were expanded in the Cloncurry area, and investigations into pastures, fodder trees, and fodder crops are continuing at Toorak Field Station.

In the central-west the initial survey of the black spear grass problem was completed and a report is being prepared for publication. A report on the white spear grass problem has been prepared. It indicates that the use of grazing crops and a more rational use of burning will control this serious pest.

The native legume studies are continuing and it has been found that Bullamon lucerne has a much wider distribution than was previously thought.

In the south-west, a trial was initiated to examine the effect of cultivation and variation in soil fertility on feather-top wire grass, which is at present a serious problem to the sheep industry in many parts of the open country in the west.

Increased pasture work under the terms of the Wool Research Fund has been planned and approval is being sought for a large-scale grazing trial to examine the effects of small areas of lucerne and different stocking rates of native pastures on sheep health, wool production and pasture composition. The importance of lucerne as a pasture legume in the traprock country was again evident during the year.

A trial to examine the effect of different times of burning on the yield and composition of native pastures in the Texas area has also been planned for the coming year.

BEEF CATTLE INDUSTRY

Drought conditions persisted in the Far South-west throughout 1959, but rains in January-February provided relief to much of this area.

CROP IMPROVEMENT

Plates 1 and 2.—Hybrid grain sorghums promise improved yields. By growing breeding plots at Millaroo Regional Experiment Station on the Burdekin in the winter (top), and transferring the progenies to Hermitage Regional Experiment Station on the Darling Downs for the summer season (bottom), plant breeding work is speeded.

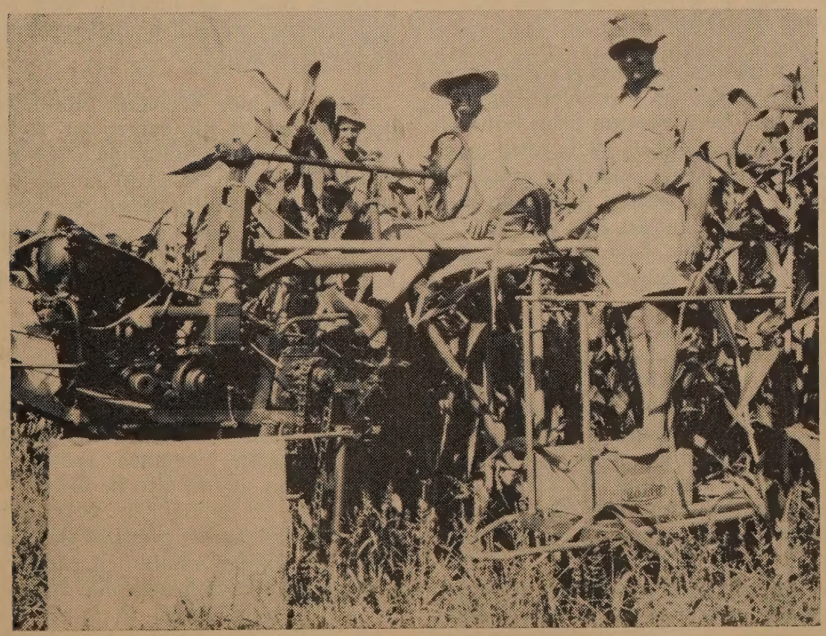


Plate 3.—A maize detasselling machine reduces hand labour in the production of certified hybrid maize seed on a Cooroy farm.

Most parts of western Queensland experienced conditions drier than normal throughout 1959.

In the eastern portion of the State, particularly in southern and central districts, rain in spring and early summer gave good early feed. However, the wet season terminated in March and pastures deteriorated rapidly in the autumn. The early termination of the wet season did not provide favourable conditions for growing winter grazing crops.

Fairly widespread rain was recorded in May, but this was sufficient only for temporary relief except in some areas of central coastal and southern Queensland, where falls were heavy.

Following the record level of turn-off of cattle for slaughter in 1958-59, the number of cattle killed in 1959-60 decreased by over 21 per cent. on the figures for the previous year. Export meatworks in Central and Northern Queensland generally ceased operations earlier in 1959 than usual and commenced operations in 1960 somewhat later than usual.

It is considered that the decline in turn-off of beef is partly due to a temporary shortage of cattle for slaughter caused by much greater than normal output in 1958 and the first six months of 1959. The heavy demand for lower grades of beef for the U.S.A. market which operated from October, 1958, resulted in the sale of many culled cows and young male cattle which would normally have been retained for another year for fattening.

The shortage of cattle for slaughter is likely to continue for the remainder of 1960. However, in the long-term, the potential output of the beef industry is almost certainly greater now than it has been at any time in the past.

Throughout the year prices for all classes of cattle were maintained at levels highly satisfactory to sellers. There was a heavy demand for beef for export to the United Kingdom and to the United States of America.

In the United Kingdom, demand for Australian beef has been heavy because of reduced supplies from other sources. Beef exports from both the Argentine and New Zealand in 1959 were much below those of recent years and the supply of home-killed beef in the United Kingdom was also reduced. However, in the first two months of 1960 supplies from the Argentine showed a marked increase on the figures for the corresponding period in 1959.

In the U.S.A., several factors operated during 1959 to maintain demand for beef from Australia. A ban on the import of meats, except canned meat from South America, imposed in May, 1959, created a strong demand for low-quality beef for manufacturing purposes. An overall shortage in the supply of beef for the demands of the U.S.A. market caused cattlemen in that country to retain female cattle for breeding purposes, and this aggravated the shortage. However, the numbers of beef cattle in the United States are increasing, and this can be expected to lead to an easing of the demand for beef in that country.

There were notable developments in all spheres of the industry during the year. In the field of transport there were major developments, particularly in the more remote areas of the State. The decision taken by the State Government to proceed with the development of a network of roads servicing the Channel Country will assist producers in the area to utilise to a much greater degree the potential of that area for production of an increased volume of high-quality beef. The provision of improved roads in the Cape York Peninsula and the initiation of improved services for sea transport of cattle will likewise assist in achieving greater turn-off from the Peninsula and the Gulf country.

Additional slaughtering facilities have been provided in certain areas, the most notable developments being increase in the capacity of the meatworks at Cairns and the commencement of operations at the Roma meatworks.

Interest which has been shown by most graziers over recent years in improved methods of cattle husbandry has been maintained. One of the most interesting developments during 1959-60 was the adoption of the feed-lot system of fattening in certain areas. High prices of beef combined with plentiful supplies of grain aroused interest in this method. Under the conditions which operated during the year, fattening of cattle under this system was a sound proposition economically. It appears that this system could have a place in the industry as a method of fattening cattle at times when output of fat cattle is limited through lack of fattening pastures or grazing crops.

Evidence of the value of pasture improvement to the stockowner continues to accumulate.

Grazing trials at Brian Pastures have shown that in areas where sown pastures with lucerne as the legume can be grown, it is possible to double carrying capacity and treble liveweight gains. Corroboration on a commercial basis is also available. On the northern Darling Downs, pastures based on lucerne, such as green panic and lucerne, are still highly productive at the age of seven years.

The evidence for the productivity of sown pastures based on centro or stylo in the wet tropics is now irrefutable. It has also been proved that gidyea scrub in the semi-arid areas can be successfully sown to buffel grass and that this grass will do well in considerable areas of the north-west, west and south-west, with resultant marked improvement in productivity.

The development of the brigalow areas to pastures, though accompanied by some risks due to suckering, has also been accepted as a practicable and necessary avenue for land utilisation. Suitable grasses are available commercially and, where possible, legumes such as lucerne and phasey bean should also be used.

The more remote areas of the Gulf and Peninsula with annual rainfall in excess of 30 in. are well suited to Townsville lucerne.

It is thus apparent that by using pasture species which are commercially available now, the productivity of the State's beef cattle pastures can

be increased considerably. This improvement will be further enhanced if species now under test prove of value under Queensland conditions. The attitude of landholders to this picture of pasture improvement potential is largely governed by economic considerations. Thus the buoyant beef market has increased the interest of cattle breeders and fatteners in sown pastures, while the wool-growers' attitude is generally more cautious.

Several factors are considered to be operating against active pasture improvement work. These include the need for improving water and fencing, the long-term nature of the work and, in the remoter areas, the feeling that if improved pastures are used for fattening, the inadequate transport facilities will result in too great a loss of condition before reaching the meatworks. This last objection overlooks the fact that suitable improved pastures will increase carrying capacity and enable a greater turn-off of animals as stores rather than as fats.

The satisfactory beef markets, the realisation that long-term export requirements will be based on high-quality young carcasses and the proven results from research work have stimulated the continued development of sown pastures in those areas adjacent to killing works. It has been estimated that in the wet tropical belt from Sarina to the McIvor River north of Cooktown, an area of 250,000 acres could be developed to sown pastures based on the legumes centro or stylo, with an annual turn-off of 100,000 export quality carcasses. Pasture development is proceeding at the rate of 3,000-4,000 acres per year in this area.

Interest is also accelerating in the subcoastal cattle regions of the Burnett and Fitzroy Valleys. Extensive clearing of brigalow scrub mainly for cattle pastures is also being carried out in the Nebo and Rolleston-Springsure districts.

Research into problems facing beef producers will be greatly stimulated by the provision of monies from special taxation and Commonwealth Government grants. It is confidently expected that the increase in basic and applied research and in extension work will quickly result in improved efficiency of production.

Special mention must be made, too, of the recognition by all mainland States that contagious pleuropneumonia is a problem of national import and there is reason for believing that all those States will make special contributions towards fighting this disease in Queensland herds.

DAIRYING

Butter production was appreciably lower at the beginning of the year than for the corresponding period in the previous year, due to dry seasonal conditions in the dairying districts. However, cheese production was maintained on a higher level during this period.

The south-eastern dairying districts benefited from the useful rains in September, and the resultant improvement in seasonal conditions led to a steep rise in production, particularly of butter. Attributable to the further good rainfalls during November and December, the peak production was reached in December, which is rather earlier than normal.

Although there was not the usually heavy late summer rainfall, falls were ample to maintain production at a satisfactory level until March. The run-off was insufficient to fill many water storage dams. The quantities of butter and cheese for the first nine months of the year exceeded those of the previous year, but later dry conditions, together with the normal drying-off of many cows, resulted in a marked decline in dairy production from April to June.

The total production for the year of 38,933 tons of butter and 8,492 tons of cheese represented a decrease of 2,089 tons of butter and an increase of 272 tons of cheese compared with the previous year.

Due partly to seasonal conditions and partly to a joint quality improvement effort between the industry organisations and the Department, there was an improvement in butter quality, while cheese quality remained at the satisfactory level of recent years.

Milk is conveyed by rail from Toowoomba, Rockhampton and Malanda to towns as far west as Quilpie, Longreach and Mount Isa, respectively, the last being about 1,000 miles from the source of production at Malanda. The confidence of the three Dairy Associations responsible for this service in the expansion of western sales of milk has been justified. During the year sales in the above areas increased from approximately 960,000 gallons to 1,200,000 gallons. School milk is supplied in every instance where a township is serviced, and to a number of smaller towns along the route. Whereas 17 western schools on the Toowoomba-Quilpie line were receiving pasteurised milk in 1956, 67 are now doing so. An excellent service is thus provided to centres where pasteurised milk was hitherto unobtainable, and is contributing appreciably to the health and well-being of the State's population. Another important feature is that as the sale of market milk increases, the amount of dairy produce which would otherwise have to be exported to less profitable markets is correspondingly reduced.

The consumption of milk has shown a steady increase in all areas where pasteurised milk is available to the public. The consumption for the Greater Brisbane area was 18,786,000 gallons, compared with 18,500,000 gallons in the previous year. The price paid to producers remained the same at 3s. 7¼d. per gallon.

Financial assistance received from the Australian Dairy Produce Board and Shell Chemical (Aust.) Pty. Ltd. has enabled a detailed programme of pasture experimental work to be continued. One hundred and two projects have been conducted during the year in the main dairying districts from the Atherton Tableland to the southern border and as far west as Chinchilla.

The intensified work on dairy pastures has again shown marked responses by coastal pastures to nitrogen fertilizers. The use of fertilizers containing nitrogen is increasing in the dairy industry,

SHEEP AND BEEF CATTLE PASTURES

Plate 4.—Shutting up central-western sandridge country has encouraged the development of black spear grass. Regular grazing of the paddock on the left by sheep has kept this grass pest out.

Plate 5.—In the Central Highlands, protection from overgrazing by sheep has permitted the regeneration of Queensland blue grass in the enclosure on the right. These two illustrations show the importance of grazing management studies of native pastures.

Plate 6.—The pasture plant museum at "Brian Pastures" Beef Cattle Pasture Research Station in the Central Burnett.

particularly on farms supplying wholemilk. Phosphate is essential for vigorous clover growth in the coastal country, while lucerne survival in this environment depends on the use of lime. The use of fertilizers on pastures is expanding rapidly, although at 1,600 tons per year it remains only 0·14 per cent. of the total used in this State for all purposes.

The place of sod-seeding for winter feed under Queensland conditions is also being studied, and it is apparent that soil moisture is the major limiting factor in this practice. It is assuming some importance in irrigated pastures where grasses or oats are being seeded into clover-dominant pastures.

Further evidence has been obtained in the value of tropical and subtropical legumes in south-eastern Queensland, and the place of centro, stylo and *Desmodium uncinatum* in frost-free areas, particularly where weeds such as blady grass, bracken, groundsel and lantana are a problem.

An increase in the acreage under irrigated pastures was noted during the year, the main increase being in the south-eastern Darling Downs and western Darling Downs, where additional areas of 300 and 500 acres respectively have been planted.

The Brisbane–Gympie coastal area has also increased the areas sown to pastures. These pastures are being used for production of wholemilk.

For the herd-recording year ended September, 1959, the average production per cow in all recorded herds reached 170 lb. of butterfat, which is the highest figure attained since the grade herd-recording scheme began in 1948. It is particularly gratifying to note that in over 23 per cent. of all herds recorded average production per cow exceeded 200 lb. butterfat. While the increase in production per cow may have been due in part to favourable seasonal conditions, there can be no doubt that it also reflects a general trend towards the adoption of improved methods of husbandry on dairy farms.

Average milk and butterfat production per cow in Queensland dairy herds is well below the levels attained in temperate areas such as New Zealand and Victoria. However, progress is being made towards the solution of the problems of dairy production in the tropical and subtropical environment in Queensland dairying districts. Trials carried out on private properties and at Departmental experiment stations are indicating methods whereby production can be raised by methods which are practicable on a large proportion of the State's dairy farms. At the Regional Experiment Stations at Kairi and Biloela, significant increases in production of the dairy herds have been obtained through use of improved pastures, grazing crops and fodder conservation.

During the year the Department entered a new field of research in dairy husbandry with the commencement at the Ayr Regional Experiment Station of a programme of cross-breeding between the Sahiwal breed and European breeds of dairy cattle. The Sahiwal is one of the most promising of the Indian breeds of dairy cattle. Animals of this breed have been supplied to the Department by C.S.I.R.O.

Action was taken for the implementation of a sales promotion and research scheme by the Australian Dairy Produce Board, the financial provision for which was obtained by means of levies on all butter and cheese manufactured in Australia. Approved research projects are subsidised by the Commonwealth Government on a £ for £ basis.

Several dairy farm and manufacturing research projects sponsored by funds made available by the Board were commenced. This scheme, which is likely to be a permanent feature of the activities of the industry, can be expected to aid in the more rapid solution of some of the complex problems caused by the warm climatic conditions under which dairying is carried out in this State.

World consumption of dairy products was high in 1959 but somewhat below the level of 1958, which was a post-war record. In 1959, supply was affected largely by the long summer drought in Europe. It was fortunate for Australia that favourable weather conditions enabled increased exports about this time to the United Kingdom, where, on a market with low stocks, prices for Australian butter reached a peak of 409s. stg. per cwt. in October, 1959. Prices for Australian cheese in the United Kingdom remained stable at about 290s. stg. per cwt. until the end of 1959, when the arrival of new season's production was accompanied by price falls in both cheese and butter. At the end of June, 1960, spot prices for top-grade Australian butter and cheese were 309s. stg. per cwt. and 205s. stg. per cwt. respectively.

Following the good recovery from last year's drought, general throughout Europe, including the United Kingdom, milk production will probably show a substantial increase in 1960. Increased exports of butter and cheese to the United Kingdom are likely to cause average prices for 1960 to be considerably lower than in 1959, but it is unlikely that they will reach the low levels of 1958, when Australian butter was sold as low as 205s. stg. per cwt.

The anticipated fall in export returns and the increased supplies available for export again focus attention on the weaknesses of the stabilisation scheme, which, for its success, is dependent on the voluntary co-operation of manufacturers. It is with a recognition of these weaknesses that the Australian Dairy Produce Board is actively pursuing its sales promotion and research programmes, finance for which is provided by levy in terms of Commonwealth legislation enacted towards the end of 1958.

The Butter and Cheese Marketing Boards in Queensland have also been active in their efforts to increase consumption of dairy products on the local as well as the export markets.

The Sales Manager of the Butter Marketing Board last year as a member of a Commonwealth Trade Mission visited Central and East Africa. In particular, an endeavour was made to obtain some of the Rhodesian market, which at present is enjoyed mainly by South Africa and Kenya. Visits were subsequently made to Rangoon, Singapore and Bangkok, aimed at consolidating the Butter Marketing Board's market in those areas.

Plate 7.—Grafted passionfruit vines with a *flavicarpa* stock and an *edulis* scion have almost completely replaced seedling vines. The new techniques of raising plants were worked out at the Redlands Experiment Station.

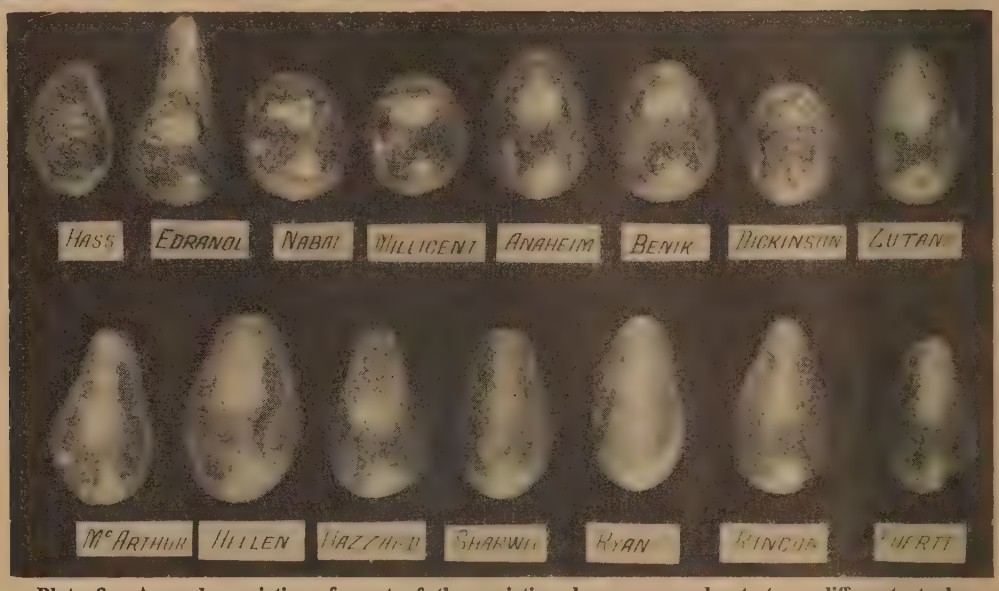


Plate 8.—Avocado varieties of most of the varieties shown are under test on different stocks at Redlands Experiment Station.

Plate 9.—The Sunnybank papaw is represented in selections from commercial plantations under test at Redlands Experiment Station.

Sales of Queensland cheese to Japan for processing purposes are an encouragement that this market offers a potential outlet not only for cheese but other dairy products also.

The recent development of cultured butters to meet a demand for this product from New Australians as well as for limited export is an example of methods being explored to expand sales of dairy products. The success by cheese manufacturers with rindless cheese and prepackaging of cheese for retail sale is another.

It was with the intention of diversification from the traditional cheddar varieties of cheese as a means of increasing cheese sales on the local market that the Cheese Marketing Board, in co-operation with the Department of Agriculture and Stock, sent an officer of the Department overseas to investigate cheese manufacturing techniques so as to be able to advise the Queensland industry on the manufacture of those exotic types with which Europeans are more familiar.

POULTRY INDUSTRY

The poultry industry benefited greatly during the year under review from the relatively cheap grain prices following abundant harvests in 1959. However, it is expected that feed costs will rise substantially in the coming year due to a greater demand for grain resulting from the expansion which has taken place in commercial egg flocks, in broiler flocks, and in the growing demand for grain interstate. A rise in feed costs may temporarily curb any further expansion in the industry.

An interesting development which has taken place in the past 12 months is the introduction of bulk handling of mash by two of the larger provender mills in Brisbane. This modern service is available to farmers within a radius of 50 miles of Brisbane. It means a reduction in the cost of feed and reduces the labour needed in the distribution of feed on the farm.

Although the availability and price of feedstuffs in Queensland remained satisfactory, the fall in the net return to commercial egg producers resulted in a less favourable egg/feed price ratio than in the previous year.

Controlled production in South Queensland increased 13 per cent. on last year, with an increase of 23 per cent. in normal off-season production. Consequently, the surplus available for export as eggs-in-shell or as pulp was equivalent to 1,107,482 doz. eggs, 12 per cent. of total controlled production, compaared with 10 per cent. in 1958-59. The net effect was that the average net return to growers supplying The South Queensland Egg Marketing Board fell to 41·67d. per doz. from 44·90d. per doz. in the previous year.

Production in Central Queensland continued its upward trend, and intake by the Central Queensland Egg Marketing Board for the year totalled 578,407 doz., an increase of 28 per cent. Production in this area has now recovered to about the same level as when the Board was formed in 1947, after having fallen to as low as 113,716 doz. in 1952-53. The point has been reached where disposal of eggs surplus to local requirements is becoming a problem.

The disposal of Australia's surplus stocks is aggravated by the virtual disappearance of the United Kingdom market both for eggs-in-shell and for egg pulp, and by increasing production in former markets on the European continent. The extent to which egg production has increased in the United Kingdom is indicated by the fact that total egg production during 1959 was almost twice that of pre-war years. Imports of eggs by the United Kingdom in 1959 were 10 per cent. below the 1958 level and represented only 1·8 per cent. of total supplies of shell eggs on that market, compared with 20 per cent. before the war.

In the face of the uncertainty of export markets the Egg Marketing Board continued to concentrate its attention on the expansion of local sales. Action is being taken to improve quality by more regular and expeditious deliveries to the Board, by the inauguration of an insulated pick-up van service, improved grading facilities and the provision of an air-conditioned grading floor. Resellers and agents are being given better service by means of delivery into store. Improved presentation, sales promotion and public relations with both growers and consumers are being developed by the appointment of a merchandising manager and staff, together with the assistance of management consultants.

Broiler production—that is, chickens up to 4 lb. live-weight—has doubled in two years, the value of this industry for the year under review being nearly £1 million. There is still a ready demand both locally and interstate and it is anticipated that more than two million birds will be processed in the coming year. Queensland, with its abundance and variety of grain and its potential for producing both animal and vegetable proteins (prerequisites for successful poultry feeding), could well become the leading broiler State in the Commonwealth, for distance from markets is no longer a limiting factor. It would seem that the public prefer "chicken" meats to "hen" meats, and this resulted in a fall in the price paid to commercial egg producers for culled hens during the year under review.

Concurrent with the increase in broiler production, there was an increase in the number employed in poultry processing. In order to ensure that poultry were processed under hygienic conditions, in suitable premises, licensing of poultry slaughter-houses was instituted under regulations pursuant to *"The Poultry Industry Acts,* 1946 *to* 1959." These regulations provided for the payment of licensing fees, the compilation of monthly poultry slaughtering returns and the collection of inspection fees.

Twelve breeders are co-operating with the Poultry Section in the Queensland Poultry Improvement Plan.

THE ANIMAL RESEARCH INSTITUTE

During the period under review the laboratories of the Animal Research Institute completed 50 years of service since the establishment of the Stock Experiment Station at Yeerongpilly. It is appropriate at this time to look back over

the achievements of the half-century. When the laboratory was first established at a site in Turbot Street in 1893 its object was stated to be "the discovery by means of experimental research of the nature and origin of diseases of stock and the means of their prevention." Over the years the work of the Institute became so diverse that in 1957 its activities were regrouped to include three branches of the Department, viz., Biochemical, Husbandry Research and Pathology.

The Pathology Branch has continued to follow the tenets originally laid down. With the passing of the years a very considerable knowledge of animal diseases has been accumulated in the laboratory, and in recent years it has become necessary to devote more and more time to their diagnosis, so that prevention and control methods can be applied to best advantage. The value and importance of this diagnostic service can be judged from the fact that at present it occupies more time than any other activity.

One of the early reasons for establishing the Stock Institute was to enable studies of the tick fevers of cattle to be made. This work has continued to be one of the most important functions of the laboratory ever since, and the knowledge and experience gained therefrom have formed the basis of the tick fever immunisation service. The importance of this service to the stock-owner may be judged from the fact that over the last 10 years almost 5,000 stud cattle have been immunised. At current values these would be worth at least £1,000,000. In addition, during the same period approximately 2,000 steers have been prepared and despatched for use as "bleeders." It has been estimated that these would have supplied not fewer than 1 million doses of blood vaccine, to which must be added a further 300,000 doses despatched direct from the laboratories.

Perhaps the most striking feature in looking back over earlier records is the tremendous advance in knowledge over the past 10-15 years. Prior to that time, the reports dealt mainly with the old-established diseases such as tick fever, pleuropneumonia, mastitis, blackleg and "contagious abortion." Many more infectious agents have been detected in recent years, some of them for the first time in Australia, and others described for the first time anywhere in the world.

Without doubt, however, the greatest advances have been in proving the poisonous properties of a number of plants and their association with heavy loss of livestock. The following examples of mortality listed in the Poison Plants file will serve to indicate the importance of this work:—

(*a*) In one period of six months, losses of travelling sheep in an area within a radius of about 6 miles of Longreach totalled 4,620 from 12 mobs. These were all attributed to soda bush (*Threlkeldia proceriflora*).

(*b*) Near St. George in 1940, deaths in three groups of travelling sheep were 516, 661 and 884. These were due to prussic acid in native couch grass (*Brachyachne convergens*).

(*c*) Two thousand sheep died in just over a week on one paddock in which heartleaf poison bush (*Gastrolobium grandiflorum*) had been cleared and left in heaps.

(*d*) One report relating to Georgina River disease stated that 3,000 cattle had died on one property in one year as a result of this disease, now known to be caused by the Georgina gidyea (*Acacia georginae*).

Several important diseases of horses, including Birdsville disease, coastal staggers, oesophageal disease, hoof shedding disease and "walkabout" disease are now known to be caused by the ingestion of toxic plants. Even pigs and poultry do not escape and sometimes suffer severely from poisoning.

In almost every annual report reference is made to deaths and sickness due to known and suspected poisonous plants. If the knowledge made available by years of investigation was generally applied, much of this loss could be avoided.

A disturbing feature noted in the reports is that during the half century at least two and possibly more infectious diseases have entered the State without warning. In 1936, ephemeral fever, first identified at Oonoonba, penetrated from northern Australia through Queensland and as far south as the New South Wales-Victoria border in a matter of 12 months. In 1958, a viral diarrhoea of cattle spread northward from New South Wales and within a few months had reached the Atherton Tableland. These invasions, without warning and from quite opposite directions, emphasise the need for preparedness at all times as we may not be so fortunate in the future as to escape with such slight effects as produced by these two diseases.

Although a great number of diseases has been recognised over the years, new ones are encountered each year. It seems that this is inevitable, as changes in methods of husbandry will undoubtedly produce their own problems.

Facing the future, we can be more confident than ever before. For the first time the staff numbers of the Pathology Branch are approaching adequacy for the work planned. There are sufficient veterinary pathologists now available to permit specialisation in one species. Thus, diagnostic work and research projects relating to each species of animal are dealt with by one pathologist. This is believed to be the ideal arrangement. There is now a sufficient number of trained officers in the several sections to enable the steady application of existing methods and to develop new lines of research. There is also a nucleus of experienced and well-trained senior men able to direct and train the more junior staff.

A major development of the Institute in 1953 was the acquisition of some 360 acres of land at Rocklea for the establishment of the Animal Husbandry Research Farm. In 1954, a Husbandry Section was formed under the Director of Research at Yeerongpilly. In 1957 this section received full status as the Husbandry Research

IMPROVED MILKING TECHNIQUES

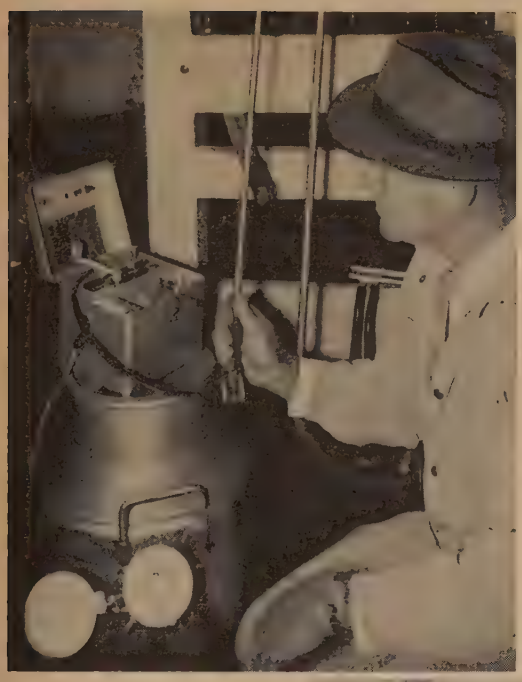


Plate 10.—A dairy machinery adviser using an air-flow meter and a vacuum recorder to test the efficiency of a milking machine.

Plate 11.—Equipment designed by a Departmental officer is in use in studies of machine milking.

Plate 12.—This is the recording unit associated with the equipment shown in Plate 11.

Branch and is now one of the three Branches constituting the Animal Research Institute. The main experimental facilities are located and are being expanded at Rocklea.

In June 1960 the staff of the Branch consisted of the Director, four graduate Husbandry Officers, a Farm Manager, four laboratory assistants and eight ancillary staff. One of the Husbandry Officers was overseas during the whole of the year under review, undertaking post-graduate studies in animal nutrition, while another, a recent graduate, is receiving part-time post graduate training in animal genetics at the University of Queensland. Both these officers will return to full duty during 1961.

Although not in the initial establishment at Yeerongpilly a biochemical laboratory is now an integral part of the Research Institute.

An indirect association of biochemistry with the Institute dates back some 25 years, when staff of the Agricultural Chemist's Branch introduced the use of some biochemical techniques to assist in the diagnosis of disorders in livestock. Also about this time facilities were made available at the Institute for biochemical staff from the Head Office laboratory to undertake investigations on the nutrition of sheep. Some of these findings were published in a paper entitled "The Nutritive Value of Some Queensland Fodders."

This collaboration continued and in the period 1951–1953, the biochemical and toxicological sections of the Chemical Laboratory of the Division of Plant Industry were transferred to Yeerongpilly. At this stage total staff of these sections was five graduates and one cadet. In 1956 they were combined to form a Biochemical Branch within the Division of Animal Industry. The present staff consists of 10 graduates and five technicians.

PASTURES

Pasture investigations have been expanded during the year and a total of some 420 trials ranging from fundamental research projects to simple exploratory and demonstration plots are now in progress. These are scattered over most of the State from Cape York Peninsula and the Gulf to the southern border.

Financial assistance for pasture research work was again received from the Wool Research Committee, the Wheat Research Committee, the Australian Dairy Produce Board, and Shell Chemical (Aust.) Pty. Ltd. The Beef Cattle Pasture Research Station, "Brian Pastures", near Gayndah, is owned by the Australian Meat Board and operated by the Department. It provides facilities for a large number of important basic investigations, which are arousing keen interest in the grazing community.

The establishment and maintenance of demonstration and exploratory plots have been assisted by Commonwealth Grants. The exploratory type of plot is playing an important part in stimulating interest in improved pastures in grazing areas. Where such plots have shown that one or other of the pasture species being tested is adapted to the local environment, the co-operating landholders are planning increased pasture development based on the results of these trials.

The search for new species continued and seed of 129 pasture species, including both legumes and grasses, was received for testing. Seed of native pasture legumes is being collected in order that their adaptability to genetic manipulation may be examined. Some of these native legumes already have the capacity to assume major importance in localised areas of native pastures or under certain conditions of cultivation.

Other important extension aids are the Royal National Association's competitions for Pasture Improvement and Water Harvesting, which are organised for the Association by this Department. Judging is carried out by officers of this Department and the Irrigation and Water Supply Commission and by specialists from private industry.

Field days held on the winning entries in the pasture competition at Kaimkillenbun (near Dalby), at Mt. Tamborine, at Blackall and at Emu Vale (near Warwick), and on the successful water harvesting entries at Conondale and Marburg, aroused considerable interest. The value of these field days is increased by the fact that an entry in the competitions must be worked in conjunction with the remainder of the property, so that pasture improvement is placed on a commercial basis.

Basic research being carried out at "Brian Pastures" is concerned with the behaviour of important pasture species under different management techniques. The study of the effects on leaf, stem and root development of various times, frequencies and degrees of defoliation and the combined effect on plant production and persistence will provide information required to place the art of pasture management on a rational scientific foundation. This work involves both grasses and legumes.

Pioneer research work into the problems of the establishment of pastures on the heavy black soils of the Darling Downs has revealed striking differences between the native blue grasses and the introduced species, Rhodes grass and green panic. An understanding and practical solution of the difficulties involved in growing pastures on these soils is of importance in the soil conservation programme for this region.

SUGAR

The 1959-60 sugar crop was estimated at 1,218,000 tons of 94 net titre sugar, some 200,000 tons less than the previous year's record production. As was the case last year, a large tonnage of cane was left unharvested.

Further progress was made in the installation of bulk loading facilities with the opening of a fifth bulk terminal at Mourilyan Harbour, to absorb the production of Mourilyan, South Johnstone, Babinda, Goondi and Tully mills. The other four bulk terminals opened since the 1957 season are at Bundaberg, Mackay, Lucinda Point and Townsville.

The average price for the 1959 season for Home Consumption, Surplus and Excess Sugar, of £47 8s. 11d. per ton, was £1 4s. 11d. higher than in the previous year. Overall the average return was influenced by an increase in May of 1d. per lb. in the retail price of sugar, which had remained unchanged since May, 1956.

At the annual talks under the Commonwealth Sugar Agreement, the negotiated price for 1960 was fixed at £44 8s. 10d. stg. per ton, a decrease of 13s. 2d. per ton on the 1959 price. The negotiated price (£ sterling per ton) during the last six years has varied as follows:—

	£	s.	d.		£	s.	d.
1955 ..	40	15	0	1958 ..	43	16	8
1956 ..	40	15	0	1959 ..	45	2	0
1957 ..	42	3	4	1960 ..	44	8	10

The Agreement, extended for a further year, now runs until the end of 1967.

GRAIN CROPS

The 1959-60 Queensland grain harvest, estimated at about 28 m. bus., was about 18 per cent. below the previous harvest. Dry conditions during the later part of the growing period and a wet harvest accounted for most of the reduction.

Wheat

Although the area sown was slightly larger, the 1959-60 wheat crop produced about 13 m. bus., compared with just over 16 m. bus. in the previous year.

A most unusual distribution of summer rains, with heavy falls in October-November in the main wheat-growing districts, led to considerable upset of the harvesting and to a direct loss of wheat estimated to reach at least one million bushels. Grain quality was also reduced to well below average. This unusual harvesting season led to greatly accentuated storage problems due to high grain moisture content.

Hail damage caused a loss estimated at approximately 650,000 bus.

Crown rot was fairly general in all crops on the Darling Downs and some 30 per cent. of the crops of the Maranoa showed some infection, but so far this disease has not been recorded from Wandoan or Central Queensland.

Stem rust caused negligible losses during the season. However, because of the recent occurrence of new strains of stem rust, the varietal situation in Queensland is possibly less satisfactory at the moment than it has been for some years. Late in the season, particularly along the timbered Condamine River area, Spica was attacked by stem rust, though too late to affect its yield. This may well point to the end of Spica as a commercial variety. Glenwari was also attacked by this new strain of rust. A new race of leaf rust against which the Mentana resistance is ineffective was also recorded from Brookstead this year. In the slower maturing group, neither Lawrence nor Hopps was reported to be affected by any new stem-rust strain.

The new rust-resistant variety Kenora came through trials on 29 farm properties with indications that it will be a useful commercial variety. It showed a greater tendency to lodging and frost damage than Spica or Festival and some susceptibility to flying smut. Its yield capacity appears to be at least equal to that of other leading varieties. Hopps, the second rust-resistant variety released commercially for the 1959-60 season, yielded well as a straight grain crop though it was released as a dual-purpose variety.

In the present planting season, some 23,000 bus. of Kenora and 4,500 bus. of Hopps seed have been distributed to commercial growers by the State Wheat Board. Some 300 acres are expected to be planted to Lawrence x Gabo 5391 for seed increase.

Almost 40 per cent. of the Darling Downs harvest was handled in bulk, and a higher percentage still would have been handled in this way had the harvest season been good. In addition, bulk handling practices are now commencing in the Rockhampton, Callide and Upper Burnett districts. State Wheat Board facilities for the coming season are planned to handle between six and seven million bushels in bulk.

The Board's new bulk terminal at Pinkenba is now in full operation and all bulk wheat exports from the 1959-60 crop are being shipped through it.

During the year 2·75 m. bus. of wheat surplus to local requirements were exported from Queensland at an average premium of 1s. 6·4d. per bus. above the Australian f.a.q. price.

A new International Wheat Agreement came into operation on August 1, 1959 and covers crops from 1959-60 to 1961-62 inclusive. Under the Agreement, the maximum price is fixed at C $ 1·90 (about 17s.) per bus.; the minimum price is fixed at C $ 1·50 (about 13s. 6d.) per bus. The Agreement is likely to cover over 400 m. bus., compared with 295 m. bus. under the old Agreement.

The completion of plans for the Wheat Research Institute at Toowoomba is an important step forward not only for the wheat industry but for other industries that will benefit from the research to be conducted at the Institute. The estimated capital cost is £110,000, which will be available over a period from the Wheat Research Levy of one farthing a bushel. To help finance the early construction of the Institute, the Queensland Government is providing an interest-free loan of £40,000 for eight years.

The Institute will be controlled by the Wheat Industry Research Committee. The Department of Agriculture and Stock has agreed to provide five research officers to work at the Institute on such matters as soil fertility and plant diseases.

Barley

The 1959-60 barley crop of 6 m. bus. was well down on the previous year's record crop of 8·1 m. bus. The area sown was higher than in the previous year but lower yields resulted from adverse seasonal conditions and there was also a high delivery of discoloured grain.

SEA TRANSPORT OF CATTLE

Plate 13.—One of the new vessels engaged in carrying beef cattle from the Gulf to meatworks on the eastern coast.

Plate 14.—Facilities are available for carrying breeding stock as well as slaughter stock.

Armyworm occurred in pest proportions on many crops, but spectacular control was obtained by aerial spraying with DDT.

Prior is virtually the only variety of malting barley grown, though if malting tests being carried out on Maltworthy are successful, it will also be made available for commercial release.

As with other grain crops, there has been a rapid increase in the quantity of this crop being bulk handled. In the last four years the percentage has risen from 6·8 through 26 and 32 to 48·6 last season.

Despite the poor seasonal conditions, the crop was still the second highest on record and the Barley Marketing Board was faced with the problem of disposing of some 4½ m. bus. at a time when Japan, the biggest buyer in the previous year, had dropped entirely out of the market. Heavy crops of good quality malting barley in the United Kingdom and Europe made marketing more difficult, although the crop failure in the southern States of Australia was a compensating factor. With lower overseas prices, export returns to Queensland growers will be down this year.

A very heavy demand from February onwards from New South Wales for feed grain drew heavily on supplies of barley normally reserved to meet Queensland's domestic requirements.

Grain Sorghum

The 1960 grain sorghum crop promised to be a little above last year's crop of 3¾–4 m. bus., but the absence of normal monsoonal rains during the early part of the year, and subsequent dry conditions in some of the main growing areas, resulted in a reduction in the crop, now estimated at about the same as last year.

On the Darling Downs, the season was generally good. Many late crops finished very poorly, being affected by the dry late summer, weeds and midge, and some were abandoned. Isolated early crops yielded as high as 100 bus. per acre. The grain was in high demand due to drought conditions prevailing in the eastern States.

In the Upper Burnett, the acreage harvested was similar to that for last season. Despite the increase in cotton acreages and the low grain prices last season, the area planted in the Callide remained similar to previous years. However, the hot dry late summer depressed yields below expectations. Acreage increased in the Central Highlands and yields were average. While a considerable portion of the crop was planted in December, January-planted crops gave better yields. Charcoal rot disease caused considerable losses in some crops in this district.

The varietal situation in this industry has shown a strong tendency to stabilise on Alpha and Early Kalo in the main production areas, with Wheatland, Martin, Caprock, Coastland and Hegari being used to a much lesser extent. However, this trend could be upset considerably in the seasons to follow by the release of one or more of the hybrid strains tested in the past season. Yields from all the replicated field trials reported to date show consistently large increases for a number of locally made hybrids over both Alpha and Early Kalo. In some plots, yield increases of up to 38 per cent. over standard varieties were noted. Enough seed of four promising hybrids should be available to plant at least 1,500 acres in the coming season.

Four growers were trained in hybrid production techniques during the season and the stage could well be set for a resurgence of interest in a crop which has tended to lose favour in recent years through poor prices. The programme of building up foundation stocks for a Certified Hybrid Sorghum seed industry has gone forward, though severe depredations by mice caused some loss of seed.

From February there was a heavy and consistent trade in grain sorghum across the border into New South Wales, while growers in many areas were reported to be holding above-normal quantities on the farm as a reserve for winter stock feeding. It is expected that the quantity reaching the normal market channels in Queensland will be considerably below last year's figure of about 72,000 tons and may not reach 30,000 tons. Local prices reacted strongly to the above influences and were well above those realised last year. As a result of a sale very early in the year, 10,000 tons of grain sorghum were exported.

Small Grains

Acreages and production of the small grains—canary seed, white French millet and setaria (panicum)—were lower than last year, a direct result of the low prices during the previous year. Prices for these small grains are subject to a fair amount of fluctuation and they are largely influenced by prices in the United Kingdom. There was some price improvement towards the end of the year.

TOBACCO

A record area estimated at 10,465 acres was sown in Queensland for the 1959-60 season, compared with the previous year's planting of 7,916 acres. Production is estimated at 9·7 m. lb., compared with 6·7 m. lb. in 1958-59. With the extension of irrigation works associated with the Tinaroo Falls dam further expansion can be expected. The acreage sown in Victoria has increased markedly and there has also been some expansion in New South Wales and Western Australia. The 1959-60 Australian crop, estimated at over 20 m. lb. from 21,298 acres, is also a record.

The growing season was generally fairly favourable. In North Queensland summer rainfall was heavier than normal after a fairly dry growing season. Widespread premature flowering of the early-planted crops in the Mareeba area caused some worry, but subsequent growth was satisfactory where crops were cut back and suckered. In the Southern Border areas the season was drier than usual and although good rains fell in November and December stream levels later became critically low.

Severe hail and wind storms caused losses in most districts, particularly in the Inglewood area, where over 300 acres were devastated by wind and hail during December. No really serious outbreak of blue mould occurred, but leaf miner was particularly troublesome. Lack of control over this pest is disturbing the growers, as the present methods of spray treatment are very expensive. Aerial spraying is becoming increasingly popular in all major tobacco districts.

Yields per acre were generally high, and gross returns of from £600 to £900 per acre were obtained by many growers.

Several developments during the year are worthy of mention. Irrigation water became available from the Tinaroo Falls Dam early in October, either directly from irrigation channels or from augmented supplies in the Walsh River and Granite Creek. Twelve new farms have so far been opened up for selection within the irrigation area and a further 60 farms have been approved for opening. Land values in the Mareeba-Dimbulah area have risen considerably in recent years and established farms are now being sold for over £100 per acre of tobacco soil. New farms are being offered by the State at £35 to £50 per acre for irrigable land.

The tobacco acreage around Bundaberg rose from just over 100 acres to 540 acres in the past season. With high yields and good quality leaf being produced in this area, a further substantial increase to over 1,000 acres is expected for the coming season. Much of the increased acreage will be on new land, costing close to £100 per acre in a cleared state.

Satisfactory prices realised at the first Brisbane sales will stimulate further tobacco production in the Beerwah-Glasshouse pineapple growing area, where 54 acres were planted last season. The shortage of irrigation water will, however, prevent any large-scale increase there.

Further developments occurred during the year at both the Parada and Inglewood Tobacco Experiment Stations. Adequate laboratory and office facilities are now available at both Stations, and the tobacco research programme is being steadily intensified with funds provided from the Tobacco Industry Trust Account. In addition to a wide range of agronomic and pest and disease investigations, field testing is being carried out on promising blue mould resistant lines of tobacco which have been bred in New South Wales. The release of one or more of these lines is now dependent on the results of manufacturing tests, and should these prove favourable the wide use of mould resistant varieties in Queensland is certain.

Prices and clearances of leaf at the 1960 auctions at Mareeba were satisfactory during the major part of the season; some difficulty was experienced at the Brandon sales, and dissatisfaction has been expressed by growers in the Burdekin areas.

Up to June 30 a total of 8,381,610 lb. of leaf was sold, valued at £5,055,813, an average realisation of 144·78d. per lb. Mareeba sales totalled 5,016,456 lb. at an average price of 150·58d. per lb., while Brandon sales totalled 1,997,703 lb. at an average price of 125·07d. per lb.

The first series of Brisbane sales resulted in the clearance of 1,367,451 lb. of leaf at an average price of 152·22d. per lb.

The increase in the Australian consumption of tobacco products has been much less rapid than the increase in production of tobacco leaf. The 1959-60 crop provided about 37 per cent. of domestic requirements, estimated at 51 m. lb.

To qualify for reduced tariffs on imported tobacco leaf, manufacturers are required to incorporate in their products certain minimum percentages of Australian leaf. The percentages to operate from July 1, 1960, have been set at 28½ per cent. for cigarettes and 24½ per cent. for tobacco. As from 1st July, 1961, these percentages will be increased to 35 per cent. for cigarettes and 32 per cent. for tobacco.

The basis of calculation of the percentages for 1961-62 appears to differ from that which has been customary in recent years, as the percentages do not cover the whole of the Australian crop available. Manufacturers have stated that a rapid increase in the amount of Australian tobacco incorporated in blends could result in too marked a change in the smoking characteristics of particular brands of cigarettes, between one year and the next, with adverse effects on the demand for those brands. The limitation of the extent of the increase in blending percentages for cigarettes for 1961-62 would appear to be an acceptance of this argument.

COTTON

The original 1959 planting estimate of 50,000 acres was drastically cut to less than 40,000 acres following the excessively heavy rains of October and November. The greatest reduction was on the Darling Downs, where flood rains swamped plantings and caused losses of stand through seed rots and soil compaction. Weed and grass competition further reduced effective acreage. In some cases replanting was contemplated but by the time land could be prepared the best planting period had passed and few growers risked a late plant.

On the Western Darling Downs those crops which were established received practically no rain from mid-December to late February. As land preparation was late, little subsoil moisture had been stored and the crops suffered severely. Yields from this area and from Wandoan are poor, probably around 300 lb. per acre.

In the main cotton areas of the Central District the position was much better and yields are varying from 500 to 1,500 lb. per acre. The average is expected to be about 700 lb. per acre in the Central Coastal section and a little lower in the Callide and Dawson.

The Bundaberg district expanded its cotton area from a few hundred acres last season to some 1,500 acres in 1959-60. Where it has been well grown under irrigation, yields of 1,500 lb. per acre are common, but closer attention to cultural details is needed as a general rule.

The St. George area suffered a severe setback from hot dry conditions and very heavy attacks of rough bollworm. Temperatures between mid-December and the end of February were consistently around 100 deg. F. and very little rain was recorded. Under these conditions water applications on the same scale as last season were inadequate. Only in one case did plants make normal growth and the yield of this planting will average about 1,000 lb. per acre. In most other cases stunted plants were developed with short internodes, and shedding of squares and small bolls was severe. October-planted crops made up to 560 lb. per acre on the Demonstration Area, while November-planted plots gave practically no yield and were not harvested.

The overall State yield is expected to be about 12,000 bales of lint, the highest since 1941.

The period covered in this report includes the last months of the 1959 ginning season. Final figures for that season showed that out of a total of 7,621 bales of lint, Glenmore Ginnery produced 4,634 bales and Whinstanes 2,987. This was the highest figure for Whinstanes for nearly 20 years and indicates the expansion of the industry in southern Queensland.

An interesting feature revealed in the figures was that 22·2 per cent. of the crop ginned at Glenmore was machine-harvested, compared with 49·7 per cent. at Whinstanes. In anticipation of an expansion, machinery firms arranged to import approximately 50 mechanical harvesters for the 1959-60 season. Most of these were eventually placed but some orders were not confirmed as growers' expectations were not realised. It is estimated that some 75-80 machines operated on the 1959-60 crop.

The increase in the number of privately owned mechanical harvesters from 4 in 1958, to 15 in 1959 and to 65 in 1960 indicates a changed outlook on the part of farmers towards this crop. They are beginning to regard cotton as a permanent and important feature of their farming pattern, rather han as a pioneer or sideline crop as was often the case in the past. This expansion is largely due to the activities of established growers but there has been an influx of new growers who have turned to cotton from other crops because of disappointing returns or delivery restrictions.

In anticipation of a continuance of production at a high level, the Cotton Marketing Board installed a modern 4-stand gin at its Glenmore Ginnery at a cost of about £90,000. This increases the ginning capacity of that plant by approximately 20 per cent., and, by better cleaning of seed cotton, will raise the average grade standard. A start has been made on a similar project at the Whinstanes ginnery.

There has been rapid growth in the bulk handling of seed cotton, especially machine-picked cotton, in Central Queensland districts. It is expected that these bulk handling mehods will spread to the southern areas, and the Board has under consideration the provision of bulk handling at its Whinstanes ginnery.

PEANUTS

The yield for the past season was considerably lower than that of the previous season. One contributing factor was the dry late summer in the South Burnett, which reduced the mean yield per acre from over 1,400 lb. to about 1,000 lb. This crop was harvested early, under ideal conditions.

In the Callide Valley, weeds which were a problem due to showery weather in November, and hot dry conditions in January and February, reduced yields. Harvesting conditions, however, were ideal and overall yield figures were average.

Despite a favourable season on the Atherton Tableland, yields of approximately 8 cwt. per acre were below expectations, though they were better than those of the previous two seasons. Growing conditions were excellent, with ample opportunity for weed control, and relative freedom from crown rot.

The trend towards sun-drying followed by pick-up harvesting was given a major impetus. The percentage of the crop handled by this means is estimated at 80, as compared with 50 in the previous year. The fine harvest weather, the generally low yields and uncertainty about price all contributed to this important swing towards a fully mechanised harvest.

Throughout the year the peanut industry encountered a buyer's market. As a result of the good prices received for the 1956 and the 1957 crops, there was an increase in plantings for the 1959 crop, from 34,000 acres to 60,000 acres. Relatively low prices for other crops caused many farmers to switch to peanut growing—grain and sugar farmers put some of their land under peanuts and interest was also shown by some dairy farmers. Established peanut growers also increased plantings. Good seasonal conditions resulted in above-average yields and the harvest was about 33,000 tons.

The Peanut Marketing Board has estimated that the total edible consumption of peanuts in Australia and seed requirements in Queensland necessitate an annual production of 25,000 tons (nut-in-shell basis). It must be borne in mind that actual edible consumption of peanuts is less than 25,000 tons; deshelling losses are about 25–30 per cent. and grading of the kernels, depending on the quality of the crop, results in another 15–20 per cent. being suitable for oil-milling purposes only.

Unrestricted production from the 1960 crop would have caused a serious marketing problem and the Board therefore used its powers under *The Peanut Industry Protection and Preservation Acts* to restrict production, by establishing two pools for both the Red Spanish and Virginia Bunch varieties. The total quotas were for No. 1 Pool Red Spanish 7,000 tons, and for No. 1 Pool Virgina Bunch 15,000 tons, any excess to be placed in the No. 2 Pools.

With such a large crop on hand and increased supplies available from New Guinea at prices lower than those currently charged by the Peanut

Marketing Board, buyer resistance was encountered. The Board attempted to increase consumer demand by means of an intensive advertising campaign and in February, 1960, decided to allow promotional discounts to processors on certain conditions. These promotional discounts were in effect a reduction in price and the result has been a material increase in sales.

The action of the Commonwealth Government in relaxing import restrictions on vegetable oils and oil seeds has also created difficulties.

During the year a final payment was made on the 1958 crop, resulting in a total return to the grower of 11·823d. per lb., nut-in-shell basis.

FRUIT AND VEGETABLES

Pineapples

It is estimated that the pineapple crop for the year under review will be approximately 3,278,000 cases (81,950 tons), compared with 3,894,000 (97,350 tons) for the previous 12 months. This reduction in production was due mainly to a recession in overseas prices which resulted in large quantities of fresh and canned fruit being placed on the Australian market in 1959.

The 1960 summer crop was 1,916,600 cases, of which 1,418,760 cases (35,469 tons) or 74 per cent. were processed. For the corresponding period of 1959 the production was 2,372,500 cases, of which 1,838,200 cases (45,955 tons) or 77·5 per cent. were processed.

Plantation management showed the effect of low-priced markets. Fertilizers were used sparingly, weed control was less efficient than usual, and other high-cost operations were reduced as far as possible. Yields per acre fell below normal and the drop in yield was accentuated by slow development of the fruit of the summer crop, which may have been an aftermath of low soil temperatures in spring.

Close spacing, which permits the planting of 18,000-20,000 plants instead of the usual 14,000 plants per acre, is gaining ground, and could soon become general throughout the industry. It has the advantage of increasing yields per acre at negligible cost and is an important element in efficient land use, which is a prerequisite to survival in competitive markets.

Although PCP is in general use in pineapple plantations as a weedicide, the equipment used to apply it is generally improvised and rather cumbersome. However, a spray rig equipment with retractable hoses is now being manufactured for use in pineapple plantations. It has performed well in rigorous trials and could well become standard in the industry.

In short-term crops such as the pineapple, the area under crop can be increased or decreased fairly rapidly according to grower assessments of market outlets for the fruit. It is anticipated that the 1960 winter crop will be about 20 per cent. lower than in 1959. It is doubtful therefore if the total tonnage produced during the next financial year will exceed 70,000 tons. It has been estimated that the Australian market can absorb 30,000 tons as canned fruit and 20,000 tons is probably the minimum. The industry appears to have withstood the very severe setback in 1959. Satisfactory returns over a number of years have resulted in fewer unencumbered farms, and cash disbursements have been restricted to operational costs, thus enabling growers to withstand seasonal and other setbacks which would normally put the less established grower out of production.

The price for pineapples for canning from the 1959-60 summer crop was £15 per ton, delivered Brisbane, first grade, the same as last year's winter price. Only first and second grades were accepted until March, when third grade fruit was also accepted. In April, a further payment of £5 per ton was made on each grade retrospective to 1st December, 1959, and prices being paid at the end of the year were based on £20 per ton for first grade fruit.

The record pineapple production of 1959 resulted in the Northgate Cannery carrying heavy stocks of processed fruit, and necessitated large holdings of tinplate, sugar and other materials. Additional working capital to finance these large stocks was obtained with the backing of a Government guarantee.

A Pineapple Stabilisation Plan was drawn up by the Pineapple Sectional Group Committee with the object of placing the industry on a sound basis. This was to be achieved by reducing production over a period of years to a level sufficient to supply Australia's requirements and to provide a manageable surplus. The Plan, which required participation by the Commonwealth Government, was, however, not agreed to. The P.S.G.C. is now giving consideration to alternative methods of pineapple marketing stabilisation.

Bananas

The pattern of banana production has changed little during the past year. The season was characterised by well-distributed rains in most areas and plantation losses from cyclones and the like were negligible. Production therefore continued at high levels and low prices were a feature of the industry during most of the year. Growers' returns were about half those received for the previous 12 months. The area under crop showed a slight decline to 12,000 acres.

The summer crop is seldom profitable and this year the position was aggravated by heavy supplies of stone and other fruits. The more profitable winter and spring markets can only be exploited effectively by growers who, because of location or special management techniques, can harvest the bulk of their crop at that time of the year. These techniques are easier to apply in irrigated plantations than in non-irrigated plantations, and in North Queensland than in southern Queensland. It is already apparent that developments in irrigation will stabilise incomes in southern Queensland.

The availability of water for irrigation tends to restrict the choice of land for bananas; plantations must necessarily be in close proximity

ANIMAL RESEARCH INSTITUTE, YEERONGPILLY

Plate 15.—Plaque unveiled by the Premier (Hon. G. F. R. Nicklin, M.M., M.L.A.) to commemorate the fiftieth anniversary of establishment of a stock experiment station at Yeerongpilly.

Plate 16.—Dairyfarmers and graziers listening to an address by the Minister in charge of the Department of Agriculture and Stock (Hon. O. O. Madsen, M.L.A.) at an Open Day held at the Animal Research Institute.

Plate 17.—Preparation for a telecast on Channel 2 at the Animal Research Institute.

to the water. Except in recognised frost-free areas, this has its dangers, for bringing the plantation to water often involves planting in what would normally be considered cold areas. This may, in part, explain the increasing importance of spike leaf, a physiological disorder normally associated with chilling of the corm during the winter months. Selection of areas for planting is always a compromise between topographical and other factors and, in practice, the benefits to be derived from irrigation do frequently justify the taking of risks with soil type, aspect and elevation.

Many Mons Mari plantations are now established at 10 ft. x 5 ft. spacing. The principal benefits come from heavy production in the plant and first ratoon crops. Given normal times of planting, the bulk of these crops should be cut in winter and spring and sell on high-priced markets. Later ratoons are invariably out of phase and mature the greater part of their bunches during the summer months. Many growers are therefore realising the importance of planting a new area each year. With such a programme, winter and spring production from young plantations supplements summer and autumn production from old plantations and gives continuity of output during the whole year. This tends to stabilise the farm income.

Papaws

Production of papaws is expanding in Queensland and a record crop of about 650,000 cases based on a net weight of 40 lb. per case was harvested in 1958-59 from 1,093 bearing acres. Most of the expansion took place in Central Queensland and large supplies from this district reached the cannery and the fresh fruit market during the summer of 1960. It is anticipated that the 1959-60 crops will be even greater than in the previous year. For the six months ending December 1959, about 4,202 tons of papaws were processed by the factory, compared with 3,883 tons for the whole of 1958. The percentage of the winter crop processed by canneries was 38.8, compared with about 30 in previous years. This increase is due to canners' interest in tropical fruit salad, which consists mainly of pineapple and papaw.

The fresh fruit market plays an important part in the papaw industry. It provides a profitable outlet for small fruit which is characteristic of old plantations carrying their second and third crops. Although essentially a summer fruit, the papaw sells freely during the cooler autumn months, when supplies are frequently below requirements and the fruit sells at a premium. Autumn fruit in southern Queensland is the product of flowering in spring, when conditions are usually not favourable for effective pollination and fruit set. Irrigation tends to improve the spring setting, and as irrigation facilities expand, growers should be able to exploit the autumn market more effectively.

Citrus

Citrus production in 1959 was slightly below average but 1960 holds promise of a bumper crop in all parts of the State. This can be attributed to good spring and early summer rains which maintained soil moisture at good levels during the critical flowering and fruit setting periods. One incidental effect is the heavy crop of Washington Navel oranges in coastal southern Queensland, where the variety is notoriously shy-bearing.

The area under crop (4,200 acres) shows little change and production in 1960 is estimated at about 600,000 bus. Current planting data suggest a decline in the area under oranges due to increased competition on the market for this type of fruit from the southern States. There is a compensating upward trend in mandarin plantings, the main variety in demand being Emperor.

Nursery trees now available to growers are of a particularly high standard. This is indicated by the strong demand for them from the southern States. The Regulation under the *Diseases in Plants Acts* stipulating budding at a height of not less than 4 in. above ground level should lessen the incidence of tree losses in commercial orchards from root rots.

Both the Stemp mandarin and the Newton strain of Valencia Late orange show promise; they have been grown on a limited scale for observational purposes during the past five years. Stemp is apparently derived from the Glen Retreat mandarin and has fruit of comparable quality; however, the tree is more vigorous with adaptability to a greater range of soil and climatic conditions. The Newton Valencia Late orange is an introduction from Victoria; fruit quality is probably better than that of the standard Queensland strain and, in addition, the tree has the ability to hold the ripe fruit for long periods without deterioration. The latter characteristic, though important in southern States, may not be of material value here, as late-harvested Valencia Lates are rather prone to fruit-fly injury.

Large-scale production is characteristic of one orchard at Mundubbera, where there are 130 acres under crop. Production units of this size involve considerable capital expenditure in both orchard and packing shed equipment. The large volume of fruit handled, however, makes it possible to adopt modern methods of cleaning, waxing and packing which place a quality article on the market. With markets becoming increasingly competitive and consumers more discriminating, a solution must be found to the problem of reconciling production on relatively small orchards with the market demand for an up-to-date pack. The solution involves either larger production units or co-operative packing sheds. Both are essentially problems of organisation.

Apples

Growing conditions in 1959-60 for apples were much better than in the three previous years. Soil moisture was adequate at flowering and a moderate blossoming was followed by a heavy set of fruit. Conditions remained favourable until early-maturing apples were harvested, but dry conditions in February threatened a setback to the more important mid-season and late-season varieties. Fortunately, relief rains fell at that time and the crop matured normally. A record crop estimated at over 1 million bushels was harvested

and exports overseas amounted to 120,000 bus. This export total was made possible by an increased quota to make up a short-fall in the Tasmanian crop.

Plantings continued, though at a somewhat slower rate than in previous years. Most orchards now contain a reasonable balance between young and old trees. The change in the age pattern of apple orchards in Stanthorpe is reflected in the quality of the fruit. Fruit from young trees seldom keeps as well as fruit from old trees and some discrimination is needed in selecting fruit for cold storage.

For the time being, at least, tree vigour is back to normal with strong leafy growth and ample spur development. Few signs remain of drainage, salting and nutritional problems, all of which have been apparent in orchards during recent years. Recurring setbacks from dry weather at critical periods of growth give point to the widespread interest in irrigation throughout the district. Installation of irrigation facilities in the Granite Belt certainly presents problems but these are not insuperable.

Cultivation methods vary considerably from orchard to orchard and depend more on individual choice than on soil type. There is a tendency, however, for growers to restrict cultivation to the minimum and to operate their implements at shallow depths. In the shallower soils where root development is limited, this should pay dividends. Any system of orchard management which increases the volume of soil available for root exploitation must lead to better utilisation of applied nutrients and promote better tree growth.

The failure, partially or complete, of some replant orchards is still a problem. Growth of young trees is a fair measure of their cropping potential when they reach the bearing stage. On replant land such trees require more attention than on virgin land if they are to make equivalent growth, and establishment is sometimes difficult in an adverse season. Nevertheless the replant problem, whether derived from soil erosion, the incidence of pathogens or other causes, is not insuperable.

The generally short productive life of apple trees under present methods of management has focussed attention on planting systems in relation to the economics of production. C.S.I.R.O. work at Applethorpe has indicated that close planting is linked with high production in the early life of the orchard. Some commercial orchards have now been established at close spacings, and these should provide useful data on the associated problems of tree management.

Pears

The pear industry shows more animation than for some time past, and current planting data suggest that production could rise substantially during the next few years from the present level of 60,000 bus. from 400 acres under crop. Both yield and fruit quality were good in 1959-60

The relatively minor place of the pear in the fruit economy of the State is largely a matter of chance. The tree has much the same climatic and soil requirements as the apple, but is much more tolerant of difficult soil conditions, particularly in areas where temporary waterlogging is a problem. Consequently, current practice is to plant pears on soils which are marginal for apples. In lowlying areas, this increases the risk of fruit losses from black spot. Further, as with minor crops generally, the trees are handled less skilfully, and the pack is less attractively presented in the market.

There is a renewed interest in root-stocks for pears. To date, trees supplied by southern nurserymen have been accepted without question. Now that consideration is being given to local propagation at the C.O.D. Broadwater Nursery, the merits of alternative stock types are a matter of considerable interest.

Stone Fruits

As with other deciduous fruits, plums, peaches and apricots were freely available in 1959-60. Blossoming was lighter than usual but the overall set was good and average fruit size was well above normal.

Evenly spread rains were ample for fruit development and, apart from a short period in January, the crop matured in fine weather. Brown rot, which is frequently responsible for breakdown in consignments to markets, was therefore of little importance, and buyers operated freely for both city and country trades.

Nutritional disorders were less pronounced than in previous years, but evidence is accumulating that bearing trees respond to additional potassium, at least on certain soil types. There is consequently a trend on the part of growers to use fertilizers with a higher potassium content.

The varietal pattern in peaches particularly, though well established, still leaves some gaps in the flow of fruit during the season. Of the varieties and strains under observation, the only one likely to find a place in the industry is Southland. Halehaven has now an established place in the industry.

Grapes

A very good crop of grapes was harvested in 1959-60. Production in 1958-59 amounted to about 300,000 half-bushel cases from 2,721 acres under crop.

At Stanthorpe, cane growth was extremely good, bunch size large and berry colour exceptional. These reflected ample soil moisture at bud-burst and relatively fine weather during the harvesting period for the later-maturing varieties Waltham Cross and Purple Cornichon. The early-maturing variety, Muscatel, was harvested in only fair weather, but even so, wastage was not excessive.

The coastal crop, principally Muscatel and Black Hamburg, developed well but matured in damp, overcast weather. The berries lacked both colour and flavour and did not carry well. Leaf damage from mildews was extensive and post-harvest spraying for the control of these

diseases was necessary to ensure the supply of healthy canes for the 1960-61 season.

At Roma, extremely dry weather during fruit maturity was associated with poor bunch development and a considerable amount of berry shrivel. This area is still badly in need of soaking rains.

Passionfruit

The resurgence of interest in this crop consequent on the introduction of grafted vines with resistance to root rot was reflected in over-supplied markets during the summer months. Returns at that time were low and in sharp contrast to those of spring, when prices reached almost record high levels.

Fruit quality was generally good, although setting was very erratic in some areas. Several factors may be involved, such as faulty pollination, lack of vigour due to virus diseases and insect attacks.

Production is estimated at 10,040 bushel cases from 52 acres.

Strawberries

The 1959 strawberry season ended on an optimistic note with a reasonably good clearance of hold-over cannery stocks and reasonable prospects for the 1960 season. Production was satisfactory and some surprisingly good berries were picked late in the season. Production in 1959 was 1,378,000 lb. from 268 acres. The quantity processed was 584 tons, compared with 1,139 tons in the previous year.

The 1960 crop was established in March with some difficulty. Runner development began early, but hot weather in February suppressed rooting and, at the time of planting, good planting material was scarce. A fair amount of replanting was therefore necessary, and uneven stands are rather common. Subsequent growth has been very good and early picks for the fresh fruit market should be above normal.

The old-established practice of mulching the crop with tan-bark seems likely to disappear. Evidence has been accumulating for some time that the use of this material, while superficially attractive, can depress yields. Plastic substitutes are equally efficient in conserving soil moisture and keeping the fruit clean. Unlike tan-bark, they have no undesirable side-effects on plant nutrition and tend to increase overall yields.

Although the variety Majestic performed indifferently in the Redlands district, current reports indicate increased plantings on the near North Coast this year. Its inherent vigour may make it useful on the typical light sandy soils characteristic of that district.

Avocadoes

Avocado production remains more or less unchanged at 3,300 bus. from some 40 acres under crop. The industry has a number of enterprising growers and production could increase rapidly given a firm market outlet for quality fruit.

From the production point of view, the crop must still be regarded as speculative, mainly because of tree mortality following root-rot infection. Existing markets are erratic, particularly in Brisbane, where fruit from nondescript seedling trees is mainly sold. On the other hand, established varieties realise good prices on southern markets. Varieties are available which mature their fruit in succession from April (Fuerte) to December (Hass), and ample stock and scion material is on hand for propagation.

Few large orchards are likely to be established in the near future. There is, however, ample scope for plantings of 1-3 acres on many farms. These could lay the foundations for commercial developments in future.

Macadamia Nut

There is still considerable interest in the Macadamia nut, although the crop is relatively unimportant with 130 acres planted and production at about 30 tons. The greater part of the crop is processed and grower returns are satisfactory. In 1960, crops were generally heavy, particularly in some of the lighter rainfall areas of southern Queensland. Even so, the market will be undersupplied.

No major development in this crop can be expected until grafted trees of accredited parentage become available. Plantings of 1-3 acres are needed to determine the economics of production and solve problems of tree management before commercial orchards can be established with any confidence.

Tomatoes

The tomato industry recovered in 1959 with production at 1,775,780 half-bushel cases from 5,950 acres and a reasonably buoyant market during the spring and early summer months. Both yields and fruit quality were good in coastal areas.

Irrigation facilities are increasing in some of the traditionally dry-farmed areas. This is noticeably so at Stanthorpe and on the north coast between Nambour and Gympie. The latter area, though not a big producer, could become an increasingly important source of tomatoes during the winter and spring.

Supplies of Q2 and Q5 seed were adequate for the industry, but Q3 seed was insufficient to meet the demand from the north, where it is the main variety. Q5 is a Rutgers type with the ability to maintain fruit size for a long cropping period. It has only a limited appeal to growers at Redlands, but recent sales, particularly at Stanthorpe and Nambour, suggest that its merits are becoming more widely known.

In irrigation areas, particularly in North Queensland, production units show signs of increasing by the merger of adjacent properties, and a single operator may accept responsibility for 20 acres or more of tomatoes in the one season. This trend is partly due to lower returns

for fruit consigned to market, but in districts such as Bowen, it is influenced by the obvious benefits derived from placing volume consignments on the market during short periods when prices are highly remunerative. Large operators can sell fruit at a small margin of profit and can use equipment and labour more effectively than is the case on small farms.

Crease stem is becoming increasingly important at Redlands, although its economic impact is difficult to assess. Symptoms can be observed in almost all autumn-grown crops and are frequently associated with excessive vigour in the juvenile stages of growth. In acute cases, abnormalities of growth (crease stem) occur and these are associated with delayed cropping and reduced yields.

Normal commercial practice is to raise seedlings in beds and transplant them to the field. Direct seeding in the field, although it involves some problems in crop management, induces earliness of harvesting. Until recently, few growers outside the Lockyer Valley have shown any interest in direct seeding but the position is changing. Even in the conservative Redlands district some growers plant directly in the field to get better control of times of harvesting.

Peas and Beans

The French bean industry continues to expand in most districts. Stanthorpe is an exception, for in this district 1959-60 plantings were considerably below those of previous years. This may be a temporary aftermath of low prices during the 1958-59 season, but planting programmes were certainly influenced by prospects of a bumper yield from deciduous fruits grown in the area. Production is estimated at 842,330 bus. from 6,255 acres.

The metropolitan district is playing an increasingly important part in supplying the Brisbane markets with summer beans. This particular crop is difficult to grow on the coast. The success achieved by growers this year may be attributed to better irrigation techniques, the use of disease-resistant varieties and more than ordinarily favourable weather.

In areas where diseases are not a major problem, Brown Beauty continues to hold the field. Elsewhere Redlands Belle and Redlands Beauty are popular and the available seed is quite insufficient to meet the demand. Almost all the seed required by the green bean industry is now produced in Queensland under supervision, and carries warranties of freedom from diseases and root rot. Co-operation between contracting firms and the Department is becoming accepted practice. This should eliminate some of the hazards involved in maintaining seed supplies.

Fertilizer burn still causes unnecessary wastage in bean crops in all parts of the State. The young plants are very sensitive to high concentrations of fertilizer in the soil. The trouble is partly due to poor land preparation for the crop, and perhaps more important, failure to place the fertilizer below the seed. The remedy is in the farmers' own hands.

Pea crops were very productive and quality pods were available on the markets for long periods from Queensland production centres. At Stanthorpe, autumn-planted crops came through the winter very well and were sold on payable markets. Later plantings, however, suffered a great deal from root rots. Exploratory commercial plantings of pea varieties suitable for quick freezing were made in the Beaudesert district in 1959 and met with variable success. Prerequisites for the crop are irrigation facilities and precise times of planting. Out-of-season plantings which flower during periods of low temperature are seldom productive. Production was 38,600 bus. from 846 acres.

Onions

Since its reconstitution in March 1959, the Onion Marketing Board has handled nearly 4,000 tons of onions at an average realisation of £74 per ton.

At the opening of the season in July 1959, marketing prospects were the brightest for some years, as a late Victorian crop had been almost cleared. It seemed that with a moderately large crop, estimated at 15,000 tons, Queensland onion growers had the opportunity to make up for the low prices of recent years. However, the middle and late crops received severe setbacks from bacterial wilt and an unusually high proportion of the crop was of pickling grade only. Quality suffered further from above-average rains in September-November and deterioration became more marked with higher temperatures.

To assist the industry and following representations by the Onion Marketing Board, onion grade standards were amended. A No. 2 grade was introduced to allow of the marketing, during periods determined by the Minister, of sound edible onions which just failed to make the high standard of No. 1 grade.

The disquieting feature of the season's activity was the relatively poor support given their Board by growers, on whose petition this particular Board had been set up. It was not wholly unexpected that a new Board would encounter problems of organisation and management and also opposition from some trade quarters, but delivery to the Board of only a quarter of the crop was a most severe handicap. Interstate exports accounted for about two-thirds of the crop. The proximity of the main growing areas to the State border facilitates interstate trade outside the marketing authority.

Fruit Quality

Queensland is perhaps fortunate in that grade standards are prescribed by regulation for all the major fruits and vegetables grown in this State. Such regulations embody wherever possible maturity standards of quality which have been determined after many years of laboratory experimentation. The standards also prescribe in general terms other attributes of quality such as freshness, tenderness, crispness, firmness, juiciness and flavour.

The measurement of such characteristics by physical or chemical means has been particularly difficult, but much greater attention will have to be given to this question in the future. It is essential that produce offered for sale should be acceptable to the consumer. Too frequently, while produce is superficially sound, it fails to meet consumer requirements, being stale and lacking freshness, tenderness, juiciness or flavour. In some cases grower practices can be regulated to ensure that the fruit is harvested at the correct stage of maturity for maximum quality, or that preference is given to the growing of certain varieties which are known to possess superior quality.

There is a tendency for some growers to market nondescript types of fruit and vegetables, irrespective of whether their marketing is in the best interests of the industry or not. Such is the case with avocadoes. The Brisbane market has been flooded with seedling types of inferior quality, the sales of which cannot be prevented by existing legislation. In the case of fruit such as apples and pears, where large supplies are received from southern States, storage practices may have to be regulated to ensure that the consumer receives fruit of good quality. While such fruits appear to be in sound condition when they are taken out of storage they may have little quality left by the time they reach the consumer. It is becoming general practice in Queensland to transport apples and pears to their destination immediately after picking, when they can withstand transport conditions much better than if they have been subjected to a prolonged period of cold storage at the harvesting centre. By storing at the point of sale, market supplies can also be more easily regulated and the fruit can be sold only a few hours after it has left the cool store.

The popularity of quick-frozen vegetables, particularly peas, is largely due to standardisation of quality. It is now possible, by means of an instrument known as a maturometer, to predict the exact day when the peas will reach their maximum quality. Commercial enterprise has adopted this method and harvesting methods by mechanical means are applied. The result is that quick-frozen peas are uniformly good in quality and generally superior to the average quality of peas purchased off the fresh vegetable market.

The quality of pineapples is now being evaluated by Departmental officers in terms of colour, sweetness, texture and flavouring constituents. Modern equipment now makes it possible to identify and determine more easily the flavouring constituents of fruit on which eating quality largely depends. Such equipment will be installed at the new Food Preservation Research Laboratory at Hamilton. The evaluation of fruit quality may lead to a re-appraisement of cultural practices, for it is well known that fertilizer practices can influence fruit quality to a marked extent.

Packaging

There has been a keen demand, particularly by new growers, for individual instruction in the packing of fruits and vegetables, while school packing classes have had to be extended to embrace the Gold Coast, Tamborine and Gympie districts. About 680 puplis at 36 schools were given instruction during the year. It is the normal practice for the various schools to compete in local Agricultural Shows and packed cases are exhibited by the children. A novel packing competition is to be held in the Cleveland Show in July 1960, when competitors will be judged mainly on speed and aptitude for packing. This competition has aroused considerable interest in the district and an adult competition will be held conjointly with the school children.

The trend in marketing is towards bulk containers holding about 25 bus. of fruit which have now become a regular feature of retail marketing of citrus fruits and apples, particularly in self-service stores. The bulk containers are filled straight from the grading belt and contain fruits of a number of sizes, all unwrapped. The containers are handled by fork lifts, thus expediting loading and discharge and avoiding manual handling. This results in fruit arriving at its destination free from bruising. Savings in packing house and handling charges are being passed on to the consumer.

Growers are finding difficulty in obtaining case timber of correct specifications for packing fruit and vegetables. There is a trend therefore towards fibreboard containers which have the advantage over wooden cases in that they are of standard specifications, lighter and more adapted to bulk handling. With bulk harvesting operations now streamlined to reduce manual labour in the field, the grower is anxious to reduce packing and handling costs as much as possible. Some packing houses are finding it extremely difficult to obtain experienced and skilled packers and the trend must be towards mechanisation. The fibreboard carton has so far proved more satisfactory than wooden cases in this respect. A number of fibreboard cartons, mainly of bushel capacity, are being used commercially in Australia, while other cartons designed for particular fruits are under trial both locally and interstate. The question of adequate ventilation, particularly in interstate transport, still requires further investigation.

Brisbane Market

The passing of the *City of Brisbane Market Act in* 1960 marked the culmination of moves inaugurated more than 20 years ago by the fruitgrowers' marketing organisation, the Committee of Direction of Fruit Marketing. Under the Act a Brisbane Market Trust is constituted, which will be required to establish and maintain a public market in the area of the city of Brisbane for the sale and storage of fruit and vegetables.

The Trust is composed of a Government-appointed Chairman, one representative of the Brisbane City Council, two representatives of wholesalers of fruit and vegetables, two representatives of producers of fruit and vegetables, and the Director-General of Agriculture and Stock, or other person appointed as his representative, as *ex-officio* member. The first members of the Trust, appointed to hold office for three

years from June 1, 1960, are Mr. R. L. Murray, O.B.E., Chairman; Alderman H. A. G. Crawford, as the representative of the Brisbane City Council; Messrs. A. J. Martin and E. B. P. Brooks, as representatives of wholesalers of fruit and vegetables; Messrs P. J. Savage and B. Flewell-Smith, C.B.E., as representatives of producers of fruit and vegetables; and Mr. H. S. Hunter, as representative of the Director-General of Agriculture and Stock.

The decision to establish a market Trust followed upon the recommendations of a Committee set up in 1958 to investigate all aspects of municipal marketing, including the most suitable site for the location of such markets in the metropolitan area. On the Committee's recommendation, the Government acquired an area of 122 acres at Sherwood Road, Rocklea, and the Trust will now begin the task of planning the design and layout of the new market.

For many years the need for a new and modern market to meet the requirements of the city of Brisbane, with its expanding population and the growth of modern transport, had been recognised by Government and civic authorities. Previous investigation committees had been appointed in 1935 and in 1953, but for various reasons their recommendations were not then proceeded with.

When the market is established and begins to operate under the control of the Trust, wholesaling in the inner city area of fruit and vegetables, excluding heavy vegetables, will be prohibited. Fruit and vegetable wholesalers in the inner city area affected by the prohibition will not receive any monetary compensation, but will have preference in the allocation of space in the new market. At the discretion of the Trust, persons engaged in the wholesaling of fruit and vegetables in suburban areas may be allowed to continue in business, or may be granted accommodation in the new market. Persons handling other farm produce will not necessarily be prevented from continuing in business at their existing premises, but the Act contains a provision enabling the use of the market to be extended, by Order in Council, to such produce and also to other commodities such as butter, cheese, smallgoods, eggs and poultry.

Export Potential

For some years past potential markets have existed in the United Kingdom for apples marketed in April. Queensland has a geographical advantage of apples maturing somewhat earlier than those in other States, while faster ships now make it possible to land the fruit in the United Kingdom in about five weeks. Until recently growers have shown little interest in overseas markets and they have been reluctant to make fruit available for export until they have been reasonably certain that export returns would be greater than prevailing local prices.

Forward planning by exporters has therefore been impossible and export requirements have had to be met at very short notice by obtaining supplies of small numbers of cases from many growers. This has made export inspection exceedingly difficult, for many individual lines of fruit have had to be inspected over a very short period. Little use could also be made of co-operative packing sheds which could have been geared up for export had the quantity of fruit available for export been known approximately. There has been a lack of confidence by shipping companies therefore in the ability of exporters to fill the shipping space allotted to Queensland. Many of these difficulties have been ironed out at two meetings, held in 1959, of exporters, shipping companies, representatives of the Australian Apple and Pear Board and Departmental officers. The result has been that southern exporters have now taken a personal interest in the Queensland crop and a record quantity was exported this year to the United Kingdom through the ports of Brisbane and Sydney.

A modern packing house has been erected in the Granite Belt to cater specially for export and about 90 per cent. of apple exports was packed in this shed this year. The provision of these facilities, together with the formation of an Export Advisory Committee, augurs well for the future. Improved methods of storage may make it possible for bananas to be exported overseas, while outlets may be found for processed papaw and fruit salad in Canada and the U.S.A., where potential markets for tropical fruits exist. The prosperity of some of the major horticultural industries in Queensland is becoming more and more dependent on outlets for processed fruits and about 75 per cent. of the pineapple, 33 per cent. of the papaw and 70 per cent. of the strawberry crop were canned in 1958-59. In that year 79,687 tons of fruit, compared with an average of 56,232 tons for the previous five years, was handled by Queensland processors. This is approximately 60 per cent. of the total fruit production in Queensland. It is possible that the percentage of the Queensland fruit crop handled this year by processors may exceed that of previous years.

At present no special attention is being given to producing special varieties suitable for processing requirements and canners depend entirely on supplies which may be in excess of or not suitable for fresh fruit market requirements. While the smooth-leaf pineapple is suitable for the fresh fruit market and for processing, more attention will have to be given to producing strains of papaws and strawberries which are more suitable for processing than those at present available. Firm-textured types are required for canning, for the heat treatment necessary to sterilize foods in cans has a pronounced effect on texture. The Guinea Gold variety of papaw and the Majestic variety of strawberry, which are of good colour, flavour and texture, show promise as processing varieties.

Food Preservation Research Laboratory

Although construction had not been completed by then, the new Food Preservation Research Laboratory at Hamilton, in Brisbane, was occupied in May 1960. The Laboratory will be concerned largely with problems of stor-

age, transport and processing of fruits and vegetables.

Generous financial assistance towards the purchase of laboratory equipment was given by Brisbane canners, the various Sectional Group Committees of the Committee of Direction of Fruit Marketing, and the Queensland Can Company Ltd.

SOIL CONSERVATION

The rapid expansion of cultivation in the marginal farming areas of the State has focussed attention on the need to plan the safe development of these areas, while at the same time endeavouring to reclaim and to stabilise productivity on the one million or more acres of existent eroded cultivation land. Experience in the Central Highlands and in the Wandoan and Maranoa districts has shown that the clay soils usually used for cultivation in these areas are highly erodible. Water disposal problems are rendered difficult by the erratic climate, since grass species normally used on the Darling Downs for stabilisation purposes are unlikely to persist in these lower rainfall areas.

It seems that unless the cultivation in the new areas is carefully planned from the start they will face earlier and more serious erosion problems than the older districts. Such planning must not only take cognizance of topographic features but must also be based on a system of land utilization which envisages a permanent agriculture.

Existing State technical resources are able to provide for reclamation of only 1·7 per cent. of the already eroded cultivated lands per year. It is obviously impracticable for present staff to provide additional advance planning services for the 100,000 or more acres of new cultivation land being brought into production each year.

Soil Erosion

Erosion did not assume widespread proportions in the past year, but in isolated areas severe damage has resulted from high-intensity storms. The number of such storms was above normal, and in some instances their intensity was particularly high.

On the Darling Downs, high-intensity storms during October and November caused most of the damage. Near Jandowae 10 in. of rain was recorded in 24 hours from one storm, which at its peak included over 3 in. in 30 minutes. Erosion damage was particularly severe and might have been worse but for the fact that cultivated paddocks were protected by mature winter cereal crops or weed cover, and pasture land was well grassed. Where soil conservation works existed (Plate 18) they provided excellent protection. This storm resulted in serious inundation of the lower alluvia, and major financial loss occurred through inability to harvest mature winter cereal crops.

Near Pittsworth serious erosion was associated with a severe storm in which 3·3 in. was recorded in 30 minutes, while at Clifton one storm yielded 2 in. in 20 minutes. It was fortunate that a large proportion of the cultivated land in these districts was at the time protected by mature winter cereal crops.

In the South Burnett district, where summer crops predominate, serious erosion occurred on unprotected fallowed fields over about one-fifth of the district. Peak runoff reached as high as 3·5 cusecs per acre during a storm in which a total rainfall of 5 in. was recorded. Over 30,000 acres of cultivated land in the district had been protected by contour banks, and with a few exceptions the results were impressive. Some soil drift, however, occurred between banks and served to emphasise the necessity for improved agronomic practices.

In the Central Highlands one isolated storm near Clermont resulted in a fall of 1½ in. in 15 minutes, but owing to the fact that earlier rains had produced a good weed cover, only minor erosion resulted.

At Atherton the spring rains were of low intensity during the period that the land was vulnerable to erosion. When high-intensity storms did occur in late December and late February, ground cover was well advanced and sufficient to protect the soil for the short duration of the storms.

Conservation Farming

Observations during the past year further confirmed the fact that the major defence against soil erosion is the provision or maintenance of adequate ground cover. Where the soil was protected by good pastures, growing crops, stubble or weeds, the high-intensity storms lost much of their danger. The erosion risk periods, during which at least three-quarters of the total soil losses occur, are predictable on a broad basis. It seems, therefore, that greater efforts could be made by the farming community to attempt to reduce the risk during such periods. Practical steps include the avoidance of stubble burning and the adoption of stubble-mulch farming methods, the more general use of strip and cover cropping techniques and the maintenance of "rough" fallows.

Looking back over recent years, some satisfactory progress in the adoption of these practices can be recorded. Much of this progress followed the introduction some five years ago of the chisel plough, an implement which will not only work through stubble but also enables the maintenance of cloddy fallows. There has been a progressive reduction in the extent of stubble-burning on the Darling Downs, but there is still large-scale burning when the farmer considers it is economically desirable to double-crop. The burning usually occurs during November, which is a period of high erosion hazard, and until this practice is discontinued stubble-mulching is unlikely to be fully effective as a soil conservation measure on the Darling Downs. It is probable that less stubble would be burnt if all headers had a straw-spreading attachment to avoid leaving a dense windrow of trash.

There is still no evidence of any general attempt by farmers to adopt crop rotation practices which include a pasture phase. There are problems of

pasture establishment on black soils, but in the overall picture, economic and sociological factors seem to be the main deterrent. While the cash crop farmer is able to make a comfortable living without the encumbrance of stock he is likely to continue his enterprise on that basis.

Sporadic attempts have been made by a few farmers to apply strip-cropping methods, which involve the alternation of summer and winter crops in contour strips. This is a step in the right direction and could greatly assist the performance of mechanical control measures. In the Central Highlands an effort is being made to have all new cultivations opened up on the contour with grass buffer strips ½-1 chain wide at 5-10 chain intervals. Thus the whole district could start its agriculture on a modified contour strip-cropping pattern. Only moderate success is being achieved in this direction, partly because of the large number of share farmers who have no interest in long-term improvements and partly because of the poor quality of the native pastures, particularly south of Emerald.

A strip-cropping project, which was initiated on a flood section of the Darling Downs plains about three years ago, continues to give encouraging results. Erosion has been reduced substantially, and there is evidence that old washouts are gradually healing.

In the overall State picture the past year provides some hopeful signs that farmers are becoming more aware of the need for a change in the farming patterns. Many appreciate the need to restore soil fertility and to provide for soil protection. But, in general, exploitation is still the dominant theme, and this is very evident in the new settlement areas, where it might possibly be expected that the mistakes of the past would be avoided.

Group Activity

Soil erosion does not discriminate between property boundaries, and the resolution of the problem usually requires community action by all members of a common drainage area. For this reason it is desirable that soil conservation planning be executed on a group or catchment basis. Landholders are encouraged to form into groups, which facilitate the discussion and resolution of many aspects of the community plan, co-ordinate construction programmes, and provide a medium for encouraging the adoption of improved land use practices. More farmers showed an interest in this approach during the past year, and some new groups were formed in the Darling Downs and Burnett areas. Existing groups in these districts and on the Atherton Tableland continued to function, but in the absence of active construction programmes, the interest appears to be decreasing.

Such groups are entirely voluntary organisations without rights or responsibilities, and it is possible that their usefulness would be increased if they were constituted by statutory authority and assigned specific responsibilities.

During the year district mapping and recording systems were altered, and are now based on catchment and sub-catchment areas. Planning priorities will be determined by the extent of interest in sub-catchments, and it is hoped that the finalisation of plans and method of execution of works will be determined by sub-catchment committees.

Soil Conservation Co-ordination

The Advisory and Co-ordinating Committee on Soil Conservation, of which the Director-General is Chairman, met once during the year and was able to recommend action designed to improve co-ordination of soil conservation work in rural areas and to improve the legal tenability of plans for the integrated disposal of runoff water.

District Committees set up in the previous year were able to direct the attention of the Advisory Committee to administrative problems requiring resolution and assisted considerably in fostering an improved liaison between the various Government Departments and Local Authorities in respect of soil conservation activity.

STAFF

An analysis of the staff position shows that numerically the Department was stronger in professional, technical and clerical grades at the end of the year than in the previous year. Appointments to the permanent professional and technical categories totalled 68, but resignations and other losses amounted to 39, leaving a net gain of 29. It is evident that the supply of trained personnel is still far below requirements and only a comparatively small percentage of the requests for appointment of additional staff, especially to new areas, could be met.

Many members of the staff have undertaken advanced studies, mainly in the scientific field, but also in administration. Nine officers, including five scholarship holders, completed bachelor degree courses. Higher awards obtained were A. R. Brimblecombe (Ph.D.), R. P. Kleinschmidt, G. S. Purss and T. Passlow (M.Sc.Agr. or M.Agr.Sc.), B. J. Crack (M.Sc.), and T. H. Kirkpatrick and E. Payne (B.Sc. honours).

A number of officers were on overseas study or special assignments during the year.

Messrs. T. J. Beckmann (Senior Chemist), B. J. Crack (Soils Technologist), R. W. Downes (Plant Breeder) and J. G. Morris (Husbandry Officer) were overseas at the commencement of the 1959-60 year, having obtained scholarships or teaching assistantships which enabled them to undertake special courses in their particular professions. Mr. Crack returned from the United States of America in November, 1959; Mr. Beckmann will take up duties again in the Chemical Laboratory in September, 1960, after studying in France, the United Kingdom and the U.S.A.; while Messrs. Downes and Morris will be in the U.S.A. for some time yet.

Mr. D. S. Teakle (Plant Pathologist) was awarded an Assistantship at the University of California and a Fulbright Travel Grant. Mr. T. A. Morris (Dairy Technologist) paid a visit to Europe to make investigations into cheese-manufacturing processes in various countries.

Mr. D. H. Brice (Dairy Officer) was granted special leave for the purpose of undertaking duty at Ben Cat Dairy Farm, Viet Nam, under the Colombo Plan, and Mr. W. A. Thomas (Bacteriologist) was also granted special leave in connection with training of laboratory technicians in Sarawak under the Colombo Plan.

Messrs. S. Marriott (Assistant Director of Agriculture) and L. R. Humphreys (Chief Agrostologist) departed to attend the Eighth International Grasslands Conference in the United Kingdom. Mr. Marriott will return *via* the United States of America to study a range of agricultural subjects, and Mr. Humphreys by way of Africa to examine pasture developments of interest to Queensland.

DIVISION OF PLANT INDUSTRY

Data compiled by the Bureau of Census and Statistics show that the area under crops in Queensland in 1958-59 was 2,759,141 acres, while 418,906 acres lay fallow, making a total of 3,178,047 acres of cultivated land. Sugar cane was grown on 486,801 acres.

The total area under crops was the highest ever recorded. Further expansion in cropping occurred in 1959-60, while the sowings of winter crops in 1961 are estimated to be higher than the 1959 sowings.

Expanding crop acreages and ever-widening interest in the improvement of pastures reflect the good progress being made by Queensland's primary industries. Concurrently there is a heavier demand for extension and research services from staff of this Division.

The practical interest displayed by stock owners in pastoral areas in growing more fodder for their stock merits encouragement and will require the location of extension officers in strategic centres further west than the commonly accepted farming districts. Responsibility for providing this service falls mainly on Agriculture Branch officers.

RESEARCH

The provision of adequate facilities in the form of appropriate buildings and equipment is essential if best use is to be made of the skill and training of technical staff in solving crop production problems. Unfortunately, the erection of buildings approved for this purpose on the 1959-60 Loan Works Programme was disappointingly slow.

The Food Preservation Research Laboratory at Hamilton was occupied in May 1960 and construction will be completed by the end of 1960.

A new office-laboratory block was finished on the Inglewood Tobacco Experiment Station and a similar facility was provided at the Millaroo Regional Experiment Station.

Progress was made in planning the laboratory and glasshouse for the Pineapple Plant Physiological Unit at the Maroochy Experiment Station and construction should be completed in 1960-61.

Plans were developed a further stage for the building to house the Wheat Research Institute at Toowoomba. It is anticipated that this building will be available for occupation by the end of 1961.

Several projects are in hand on the 1960-61 Loan Works Programme which will supply some urgent needs of the Division for intensifying research.

Extension of the Chemical Laboratory at Brisbane will reduce the congestion in office and laboratory space for the staff of the Agricultural Chemist, while the erection of a new laboratory at Mareeba will provide a valuable facility for investigations on irrigated crops, the acreage of which is steadily enlarging as the water reticulation system spreads out from the main water storage in the Tinaroo Dam.

A laboratory and glasshouses for special work on insect resistance to chemicals and to extend studies on plant parasitic nematodes are to be erected at Indooroopilly.

A sorely needed facility will be provided by the erection of a building at Rocklea for the storage of crop and pasture seeds prior to their distribution for experimental purposes to various centres throughout the State.

The laboratory and glasshouses located at Redlands Experiment Station have already stimulated useful progress in plant physiological work and an extension of the laboratory is planned for 1960-61.

The development of the plant breeding programme in wheat and grain sorghum at Hermitage Regional Experiment Station has high-lighted the need for a vermin-proof seed store to protect valuable seed. Construction should commence in 1960-61.

Construction of a combined office-laboratory building is also expected to commence at Biloela Regional Experiment Station where good facilities of this nature are required to cope with the expanding experimental programme.

EXTENSION

Improvement in the application of extension techniques to inform primary producers about new and tried production techniques is of constant concern. Groups of officers who had not previously participated were given training at two special extension schools held during the year.

Further progress was made in developing co-operation with local and State farmer and grazier organisations. Divisional staff took part in schools and field days, conducted under the auspices of various bodies, to bring the results of research and the methods by which production can be improved more closely to the attention of primary producers.

Many officers assisted in judging and presenting educational exhibits at district agricultural shows throughout the State, including the Brisbane Exhibition. Judging of wheat crop, pasture and water harvesting competitions particularly occupied the time of a number of officers for some weeks.

Numerous items were publicised through newspapers and radio. It is gratifying to record the co-operation given to extension officers by these agencies.

STAFF

A total of 22 technical officers was lost from the permanent staff but 29 new officers were recruited. Losses included seven male and three female graduates, and the gains seven and five respectively. Little progress was made therefore in filling vacancies from previous years and in making new appointments to cope with increasing work.

The worst feature of resignations is the loss of experienced staff, because in most cases new appointees have to be trained in the responsibilities and duties of the positions to which they are allocated.

The Government and industry sponsored University scholarship and cadetship schemes promise to play a vital role in the future recruitment of technical staff. Already some have graduated under this system but the completion of the 1960 University academic year will be the first time that a major flow of graduates has come from this source.

Eight are expected to graduate with Agricultural Science degrees, including two whose scholarships were made possible by funds from the Queensland Dairymen's Organisation and two paid by funds from the Tobacco Industry Trust Account. An additional eight are expected to graduate in Pure Science; six of these are scholarship holders, the other two being cadetship holders.

AGRICULTURE BRANCH

During the year 1959-60, the Agriculture Branch provided advisory services on field crops, pastures, weed control, agricultural machinery and soil conservation in 31 districts throughout the State. It also maintained two tobacco experiment stations and one tropical pasture experiment station, and provided the agrostology staff for the State's major beef cattle pasture research station near Gayndah. In addition, certain Branch technical officers worked with facilities provided at three of the Regional Experiment Stations.

At most of the Branch centres a general advisory service is provided. In a few centres, however, the service is somewhat specialised, generally in the field of either agrostology or soil conservation.

Most of the 31 centres are in the relatively closely settled districts of the eastern seaboard, the subcoastal valleys and plateaux and the Darling Downs. The most westerly districts manned by Branch officers are Goondiwindi, Wandoan and Emerald (all covering both pastures and crops) and Cloncurry, which is almost solely pastoral.

One of the most important trends in recent years has been the awakening interest of graziers of the western districts in the related spheres of pasture improvement and fodder crop farming. This interest has resulted in demands for agricultural advisory services from centres such as Roma and Blackall in addition to many others in what have been traditionally pastoral areas. The rapidity with which large sections of the brigalow belt have been cleared during a period of favourable prices for beef has greatly multiplied the demands for advisory services from this portion of the State. Such demands, coupled with those from rapidly expanding crop industries such as tobacco, have severely strained the Branch's manpower resources and have highlighted the need for a more regular and satisfactory recruitment of young officers.

Technical officers, such as agronomists, agrostologists, plant breeders and soil conservationists, are all required to handle investigational or administrative work, but are also unavoidably involved in some extension work from time to time. On the other hand, the various Advisers and their assistants are primarily extension officers, but most of them also handle some form of experimental programme aimed at solving district problems for which no answer has been hitherto available.

Extension officers are convinced that the most effective of all extension media, if the most expensive, is the individual farm visit. This activity, coupled with farm experiment and demonstration plots, soil conservation survey and planning work, and supervision of certified seed production, forms the backbone of the Branch's district services.

Mass media were utilised to an increased extent for extension purposes during the past year. The most popular of such media is undoubtedly the local newspaper, followed by radio, meetings, field days, tours and other developments of the group principle. An important development in the recent past has been the organisation of "schools" for primary producers. While the majority of these schools have been for animal producers, the Agriculture Branch normally has an important contribution to make from the viewpoint of provision of stock feed. The most significant such school during the past year was that held at Roma for the Maranoa Graziers' Association. Other important schools to which the Branch contributed were one for North Queensland graziers, at Magnetic Island, and one for Atherton Tableland dairy farmers, at Kairi.

A summary of some facets of the Branch's field programme follows.

AGRONOMY

Wheat

The main features of this year's activities were the satisfactory performance under a wide range of conditions of the recently named varieties Hopps and Kenora; the interference with the harvesting of experimental and commercial areas by the continued rains towards and after crop maturity; the satisfactory completion of the second year of the 8-year-cycle rotation trial embracing continuous wheat and pasture on the open plains soil of the Darling Downs; and the outstanding performance of Festival in the field wheat competition.

The plant breeding programme was maintained at Hermitage Regional Experiment Station, with particular attention being given to rust and frost resistance and to yield and flour quality. The annual strain trial was conducted to compare new hybrids with standard varieties and several promising strains were selected for further increase and testing. The seed purification scheme is being continued and at present the varieties concerned are Festival, Spica and Kenora. The purpose of this scheme is to provide true-to-type seed stocks for commercial multiplication.

Promising new varieties and hybrids were compared with standard commercial varieties in experiments at Hermitage Regional Experiment Station, on the open plains soils of the Darling Downs and in the Wandoan district. Generally the results from these trials must be treated with some reserve because of the peculiar seasonal conditions. In the three trials at Hermitage, comparing early, midseason and late varieties, heavy weed infestation and continued wet weather late in the season affected yields and grain quality. Similarly the trials on the Darling Downs and at Wandoan were also seriously affected, mainly by the continued wet weather at harvest. The recently named varieties, Hopps and Kenora, performed very satisfactorily under these conditions.

In commercial plantings on 29 farms Kenora gave an average yield equivalent to that of Spica (29.1 bus. per acre). The main criticism offered was its tendency to lodge, but it should be remembered that many commercial varieties lodged considerably under the weather conditions prevailing at harvest.

The second year of the pasture/wheat rotation trial on the open plains soils of the Darling Downs was completed successfully. This trial was designed on an 8-year cycle comparing the effect on wheat yield and quality of a grass/lucerne pasture of one, two, three and four years' duration. Spica is the wheat variety in use. Grazing figures obtained from the pasture plots indicate a stocking rate of four sheep per acre per annum. So far no significant differences have shown up in either wheat yield or quality.

The annual Field Wheat Competition sponsored by the Toowoomba Royal Agricultural Society in co-operation with the Department of Agriculture and Stock and the State Wheat Board was a triumph for the variety Festival, which won 11 out of the 15 zone prizes, as well as the grand and reserve championships. Three of the other four prizes were awarded to Spica, and the fourth to Charter. The success of Festival was due mainly to a higher degree of resistance to weathering, a superior rust resistance, and a higher average grain protein content. From an industry angle, however, it is important to remember that Spica has given a consistently superior performance in previous seasons and it seems inevitable that the popularity of Festival must decrease in spite of its performance in the last competition, where the unusual weather conditions appeared to favour it more than Spica.

Important evidence has again come from the competition in support of a crop rotation system for wheat soils. Not only were the winning crops grown by farmers who place emphasis on crop rotation and long fallow, but also the competition has produced evidence that the incidence of crown rot is least on farms practising crop rotation. Of the best 30 entries on the Darling Downs, 21 were located on farms practising crop rotation and on these the extent of crown rot was very slight. In the remaining nine entries, where rotation with non-susceptible crops was not practised, the incidence of crown rot was more than doubled.

Other Winter Crops

Oats remains the most widely grown winter grazing crop in Queensland and it is now being grown on a small scale as far west as Charleville. In areas away from the coast some of the older varieties such as Algerian, Belar, Fulghum and Klein still give very satisfactory performances under favourable seasonal conditions. In the coastal districts crown rust is the major problem. The only crown-rust resistant commercial variety at present is Saia, though Benton, and to some extent Bovah, can be counted on to give a satisfactory grazing performance in all but the worst rust years. Of the newer varieties not yet available in commercial quantities, Landhafer and Santa Fe, both late-maturing varieties, are resistant to crown rust.

Various trials have been carried out to compare the grazing productivity of oats, wheat, barley and other winter species such as rye, phalaris and ryegrasses. In all trials oats have produced significantly larger amounts of green material per acre.

A number of promising crosses have been made by the plant breeding section at Hermitage Regional Experiment Station and these will undergo further testing against commercial varieties.

The linseed varietal trial was continued for the third season on the Darling Downs. Because of the wet weather late in the growing season the late-maturing varieties Plate and Hazeldean outyielded the standard commercial varieties, Walsh and Marine. As this type of season is unusual it is not felt necessary to change the Departmental recommendations of Walsh and Marine. Furthermore, the oil of the variety Plate is not favoured by the trade and the variety Hazeldean is particularly susceptible to the nutritional disorder which is prevalent on the Darling Downs.

This soil disorder was further studied and under certain conditions various treatments produced significant increases in yield of linseed. For example, at Hermitage Regional Experiment Station, rolling of a long fallow area gave a yield increase of 9 per cent., and spraying of a crop on a short-fallow area with zinc sulphate (at 20 lb. per acre) increased yield by 36 per cent. Most consistent results have occurred from placing the seed in close contact with zinc compounds. Sowing the linseed seed and zinc oxide dust together has been more satisfactory than applying zinc oxide broadcast. Pelleting the seed with zinc oxide dust is better still, and after encouraging preliminary trials with linseed and navy beans, further trials with pelleted seed are under way. This disorder is also being tackled from the viewpoint of basic soil research and preliminary studies show considerable promise of a solution.

Small plots of safflower grown in the Central Highlands indicated that the crop has commercial possibilities in this area. The longer growing period (20 weeks approximately) could assist farm organisation by spreading the harvest period, and the palatability of the crop residue increases the crop's value in this mixed farming area. Frosts, however, can cause damage. Market prices and freight costs may be the major factors deciding its future.

Maize

Seed of the following hybrids was produced during the year under the Department's seed certification scheme: Q.23, Q.440, Q.462, Q.526, Q.692, Q.716, Q.724, Q.739 and Q.790.

Following the Department's extensive hybrid maize testing programme over the past few years, the search for satisfactory hybrid varieties is now being pursued in only two districts—the Southern Darling Downs and the Atherton Tableland.

In the Southern Downs the early hybrid DS.28, bred on the New England Tableland of New South Wales, has long been the popular variety. In two recent trials of six DS hybrids and six Q hybrids, all hybrids outyielded DS.28 (61.1 bus. per acre). The first four places were taken by DS.65A (112.8 bus.), Q.790 (109.1 bus.), DS.303 (101.0 bus.) and Q.739 (84.8 bus.). Q.440 (83.6 bus.) is not favoured for mechanical harvesting because of its tendency to lodge. In spite of its high yield DS.65A is not likely to be widely grown because of its late maturity. The position with regard to hybrid maize varieties for this area is now regarded as being very satisfactory.

For the Atherton Tableland, where the maize is subjected to prolonged wet weather and cob-rots, no satisfactory hybrid has yet been found. Each season hybrids and single crosses from the Queensland Agricultural College at Lawes and also from the Grafton Station of the New South Wales Department of Agriculture are tested under Tableland conditions. In a recent trial the hybrid GH.128 (28 bus.) outyielded the Q material (highest yield 21.7 bus.) and the local Durum strain (22.4 bus.). In an adjacent trial GH.128 (37 bus.) was outyielded by GH.170 (44 bus.), with the local Dent strain yielding 23.7 bus. The hybrid GH.170 had also the lowest percentage of barren plants and will be tested again next season for consistency. On its performance over the past few seasons the hybrid GH.128 can be expected to outyield any of the other commercial hybrids and the local open-pollinated material. It is important to realise, however, that this hybrid is not resistant to Diplodia cob-rot and can be expected to suffer considerable loss in a severe disease season.

Sorghum

During the past year the first replicated field trials of hybrid grain sorghums and the first "apprentice" sorghum crossing plots were grown. In all, seven replicated field trials including hybrid grain sorghums were conducted at six locations. Not all details are to hand, but in five trials the hybrids gave consistently higher yields than the standard varieties Alpha and Early Kalo. The performance of most of the hybrids was consistently good, and in some instances they outyielded the standard varieties by nearly 40 per cent. The apprentice crossing plots carried through in the Darling Downs and South Burnett districts showed that seed of the four hybrids involved could be produced under field conditions without any undue difficulty.

This has been a most promising introduction to the use of sorghum hybrids in Queensland. If such results are repeated next season, it will be only a matter of a few years before hybrids completely dominate the scene in this State.

Cotton

Increased acreages of this crop were planted, partly due to the relatively low market prices for grain and partly due to the quota system of peanut plantings. The season was, however, generally unfavourable. Continued wet weather at planting and for some time afterwards affected germination and also made weed control difficult. Heat-wave conditions in February caused the loss of the early crop of bolls. These conditions affected the experimental programme as well as commercial plantings.

In a varietal trial in the Gayndah district three of the newer varieties—Dixie King (984 lb. per acre), Lankart (913 lb.) and Arkot (872 lb.)—outyielded, though not significantly, the standard commercial varieties of Miller 43.9.0 (816 lb.), Empire (807 lb.) and Miller 41S (781 lb.). Trials on the Darling Downs were upset by the heavy summer rains and weed growth.

Plate 18.—Five inches of rain in three hours caused no damage to this Darling Downs paddock protected by soil conservation works.

Plate 19.—Soybean varieties under test at Hermitage Regional Experiment Station, near Warwick.

Plate 20.—Mung beans being mown for hay on land no longer suitable for cowpeas because of stem rot infection.

The demonstration plots on the St. George irrigation area were continued, but the results are very poor compared with the previous season. High summer temperatures and low rainfall resulted in heavy demands on soil moisture and the deficit was not fully met by irrigation. In addition, damage from rough boll worm attack was heavy. October plantings again gave best results though yields were generally low (420-560 lb. seed cotton per acre).

Tobacco

Further building developments have taken place on both the Parada and the Inglewood Tobacco Experiment Stations. A new office-laboratory block has been completed at Inglewood, using Tobacco Industry Trust Account Funds, while at Parada, workmen's quarters have been erected and other buildings from the Tinaroo Falls Dam site are being transformed to provide office and laboratory facilities. Added facilities and equipment will now permit intensification of the tobacco research programme determined at a State Tobacco Officers' Conference in May.

While final results of most of the 1959-60 trials are not yet available, it is possible to mention briefly some aspects of the seasonal programme.

Varietal trials at Parada during the past season again demonstrated the yield superiority of Mammoth Delcrest, Special Virginia and Virginia Gold, as compared with Hicks, Hamilton and Golden Crest. Mammoth Delcrest has yet to undergo complete manufacturing tests, but preliminary checks reveal that it is worthy of further investigation.

Field-scale testing of blue mould resistant lines developed in New South Wales was carried out at both Inglewood and Parada. Inglewood results are not yet available, but at Parada all three lines under test possessed sound agronomic characters and yielded well. Blue mould susceptibility was variable: A1, 45 per cent.; A2, no sporing mould, slight spotting only; F_2 of A2, 22 per cent. If manufacturing tests are favourable, one or more of these lines will be available to commercial growers for the 1961-62 season, but in the meantime further field tests will be conducted.

Inglewood investigations were again set back by a severe hail and wind storm in December, and the subsequent crop had to be produced from sucker growth. Because of the known detrimental effect of chlorine on tobacco leaf quality, the possible influence of other halogens is being investigated. Results from a seedbed trial, summarised in Table 1, indicate that although methyl bromide appears to give better nematode control than burning, the bromine content of the seedling plant materials can reach very high levels.

TABLE 1

SUMMARY OF RESULTS—INGLEWOOD SEEDBED TRIAL

Seedbed Treatment	Nematode Infestation	Seedling Analysis	
		Bromine (p.p.m.)	Chlorine
	(%)		(%)
Methyl bromide	0·4	6,210	2·44
Scantlings burnt	4·5	945	1·98
"Mytone"	6·3	455	2·12
Control	28·2	460	1·99

Tobacco seed for sale to growers is now packaged under vacuum in plastic pouches immediately following surface sterilization. Tests have shown that seed packaged in this manner retains its viability to a better degree than seed stored under normal conditions.

Potatoes

Sebago remains the principal commercial variety in southern Queensland, occupying about 80 per cent. of the plantings. Sequoia is the only other variety of commercial interest.

The arrangements made with the New South Wales Department of Agriculture to test seedlings produced by the Potato Breeding Section of the New England Experiment Farm at Glen Innes were continued. The recently named variety Murru was one such seedling. However, it did not find favour with local growers because of its slow maturity.

An attempt was made to define the effect of moisture incidence and supply on potato yield and quality. The experiment based on the 1959 spring crop was seriously upset by the continued wet weather in September, October and November and no worthwhile results were obtained. A similar trial was laid down on the autumn 1960 crop and in this trial seasonal conditions were more favourable. Final details are not yet available. These studies were carried out at Gatton Regional Experiment Station.

Weed Control and Weedicides

The evaluation of the newer weedicides for weed control in onions was continued. Although less effective than in previous trials, CMU at 1-1½ lb. wettable powder per acre gave best weed control. Again CIPC was effective but a closer range of rates of application is being studied to assess its efficiency. At present prices it is considerably more expensive than CMU. Results with CDAA and 2,4-DB were unsatisfactory.

Pre-emergence and post-emergence weedicide trials were carried out on maize in the Kingaroy district. In the pre-emergence trials the yield of maize was not affected by 2,4-D applied at 4 lb. acid equivalent per acre. On the Atherton Tableland "Simazine" at 2 lb. per acre controlled the first generation of wild hops following planting, but it did not affect Mossman River grass or such annuals as star burr. Post-emergence trials have indicated that maize yields are reduced significantly only by applications of 1 lb. a.e. per acre of 2,4-D made when the crop is about 18 in. high. Although weed control is effective by both pre-emergence and post-emergence applications, pre-emergence applications are not likely to be adopted commercially because of the higher costs. At current market prices for maize, even post-emergence applications, which are much cheaper, are unlikely to be widely used.

A hormone tolerance trial on linseed was carried out at Hermitage Regional Experiment Station. MCPA and 2,4-D were applied at rates of ½ lb., ¾ lb., and 1 lb. a.e. per acre at three stages of growth, viz. pre-emergence, branching and budding. Pre-emergence applications of both hormones at all rates did not significantly reduce yield. Later applications (except MCPA at ½ lb. a.e. per acre at budding) produced significant decreases in yield; 2,4-D caused more damage than MCPA. There appears to be no safe period for application of higher rates of hormone than ¼ lb. a.e. per acre after the plants are 6 in. high. In a preliminary trial, 2,4-DB was found to be less selective than MCPA at equivalent rates.

Examination of the effect of phenoxyacetic and phenoxybutyric growth regulators on peanuts continued. As reported previously, pre-emergence applications do not cause plant damage in peanuts. Experiments have indicated that 2,4-D or MCPA applied 6-7 weeks after emergence and probably at any time during the flowering period is likely to reduce yield by about 3.5 per cent. for each ounce of acid equivalent applied. 2,4-DB and MCPB under similar conditions are likely to reduce the yield 0.45 per cent. for every ounce of acid equivalent applied. The phenoxybutyrics are therefore about one-eighth as toxic as the phenoxyacetics and can be used to control susceptible broad-leaf weeds in Virginia Bunch peanut crops.

Grasses are often more serious weed pests of peanuts than broadleaf weeds. Of the weedicides tested in preliminary trials using pre-emergence and post-emergence applications, 2,4-D, 2,4-DES and DNOSBP have shown promise. At present pre-emergence applications appear to offer best prospects of grass control.

Irrigation Studies

With the increasing use of water for irrigation and the development of irrigation areas, the Branch has intensified its studies of water application and water use. At present the investigations are being carried out in the Mareeba-Dimbulah Irrigation Area. The purpose

Plate 21.—Tobacco seed-beds in the Beerwah district.

Plate 22.—The effect of spraying linseed with hormones for weed control at the flowering stage is shown by delayed flowering of treated plots.

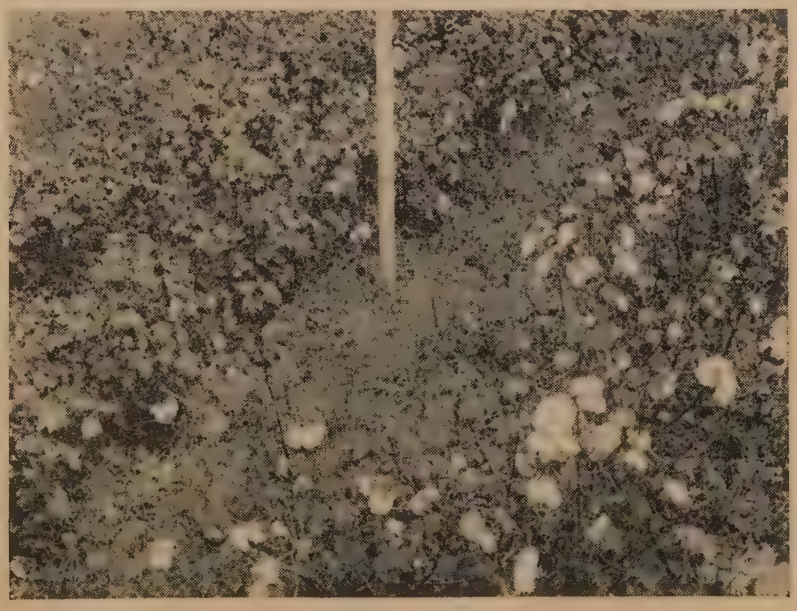


Plate 23.—Cotton plots at Ayr Regional Experiment Station. Protection from insect damage was largely responsible for the crop on the right yielding 1,650 lb. seed cotton per acre, against 450 lb. from the untreated plot on the left.

of this work is to determine the irrigation characteristics of the major soil types and to formulate efficient irrigation schedules and techniques for the crops to be grown on them. In more specific terms the following information is sought for each soil type:—

(1) Amount of water to be applied at each irrigation.

(2) Irrigation technique to be employed.

(3) Frequency of irrigation.

The amount and the irrigation technique are both functions of the soil type and the frequency of irrigation is a function of the plant and its environment. Studies to date have largely been concentrated on both soil aspects, viz. amount of water and irrigation technique.

Five soil types—Walsh, Dimbulah, Craig, Algoma and Nicotine—have been studied and field capacity, wilting point, bulk density and available soil moisture figures for each determined. The infiltration capacities of these five soils have also been determined, using the standard 12 in. diameter ring infiltrometer, under virgin and cultivated conditions. The results are set out in Table 2. The general effect of cultivation is to cut down the intake rate to one-third of that of the virgin soil.

TABLE 2

INFILTRATION CAPACITY OF SOIL TYPES

Soil Type	Intake Rate (in. per hour)	
	Virgin	Cultivated
Walsh sandy clay loam	3	1·0
Dimbulah sandy loam	8	2·7
Craig loamy sand	9	3·0
Algoma loamy sand	18	6·0
Nicotine sand	34	11·3

It would appear from these preliminary studies that soil types with very high infiltration rates, such as Nicotine sand, should be spray irrigated only.

The amount of water soaking into a soil from an irrigation furrow depends on the soil type, slope of furrow, size and shape of furrow and rate of flow. A study of the inter-relationships of these factors is under way on the five soil types already mentioned and will be extended, as time and staff permit, to other soils.

AGROSTOLOGY

A total of 420 pasture investigations and demonstrations of varying size and complexity was undertaken by Branch officers during the year. As in previous years a number of these trials were financed with funds made available by the Australian Dairy Produce Board, the Australian Meat Board, the Wool Research Trust Fund and Shell Chemical (Aust.) Pty. Ltd.

Pasture Species

Species and strains of grasses and legumes numbering 129 were received for testing during the year.

The legumes *Leucaena glauca* and Siratro (*Phaseolus atropurpureus*) obtained from C.S.I.R.O. Division of Tropical Pastures are being submitted to regional testing throughout the State. Recent accessions of *Glycine javanica, Centrosema pubescens, Desmodium, Dolichos* and *Vigna* species are a welcome addition to the pool of legumes available for testing. Throughout the State continued interest in the establishment of Townsville lucerne, centro and phasey bean has been made possible by the availability of commercial seed stocks.

Seedling regeneration of Townsville lucerne has been recorded as far west as Yalleroi. At Heatherdale, near Emerald, considerable spread has occurred in black spear grass country. It is estimated, however, that even the densest stands would not yield more than 2 cwt. dry matter per acre.

The outstanding growth and development of *Stylosanthes gracilis, Glycine javanica* and *Desmodium uncinatum* throughout coastal districts continued and this resulted in a widespread demand for seed. Experimental seedlots cannot cope with this demand and commercial seed sources are urgently required.

Results of plantings of kapok bush (*Aerva tomentosa*) in Central Queensland give little indication of this species being of value for poor country. This plant has low acceptability to cattle and has not proved easy to establish. Buffel grass, on the other hand, can be readily established in this class of country and shows great promise for pasture improvement purposes. Biloela buffel grass continued to perform satisfactorily in the pasture nursery established on brown sandy loam on the Nogoa River at Emerald, where it is considered to be superior to Molopo, Gayndah and American strains. *Cenchrus setigerus* (Q4362) continued to show a marked superiority in growth over commercial Birdwood grass on both sandy soils at Emerald and the cleared gidyea soils at Yalleroi.

At Mt. Tyson and Bowenville on the Darling Downs, the genera *Panicum, Digitaria, Chloris, Cenchrus, Setaria* and *Dichanthium* represent the principal summer grasses being tested under nursery conditions. Of these the *Panicum* species appear to show the most promise. In particular two "makarikari" types and a "bambatsi" type have impressed with their bulk, palatability and winter greenness.

Lucerne remains the outstanding legume on the black soils. Annual winter legumes under trial are useful for short-term leys, but are too dependent on the uncertain weather conditions for regular exploitation. The perennial legume Hedysarum, introduced from the Mediterranean region, shows promise for the heavy black soils, where it is extremely palatable to stock.

Pasture Seed Production

Important advances in the direct harvesting of Townsville lucerne, phasey bean, centro and scrobic seed with All-Crop harvesting machinery were a feature of the season. It has also been shown that this type of machinery can be readily adapted to harvest seed of both stylo and *Glycine javanica*. The adoption of this harvesting technique by seed growers will help to meet the expanding demand for seed of these promising tropical legumes.

Pasture Yields and Fertilizer Trials

A number of pasture yield trials were completed during the season.

Tropical pasture species established on frost-free slopes at Currumbin were sampled for the second consecutive season. The following yields of air-dry hay give some valid comparison of the growth levels that can be expected during the summer growing period without the application of phosphatic fertilizers:—

Molasses grass + *Glycine javanica*, 2.84 tons per acre.

Molasses grass + stylo, 3.76 tons per acre.

Molasses grass + centro, 4.23 tons per acre.

Legume hay samples from the above trial submitted for chemical analysis show the following protein levels on a moisture-free basis:—

Glycine javanica, 13.9 per cent.

Stylo, 14.9 per cent.

Centro, 18.3 per cent.

Pasture fertilizer trials throughout the State continued to provide information on the role that applied fertilizers can play in improving pasture production for beef and dairy cattle.

At Tinana, near Maryborough, superphosphate applied to phasey bean pastures at rates of 10, 5 and 2½ cwt. per acre gave dry-matter yields of 24.9, 27.7 and 17.5 cwt. per acre respectively, as contrasted with 7.3 cwt. for untreated pasture.

At Moolboolaman, superphosphate applied at 5 cwt. per acre to phasey bean pastures increased yields from 1.26 to 3.58 tons of air-dry matter per acre. It was also observed that the germination persistence of phasey bean on the phosphate-treated plots greatly exceeded that on the untreated plots.

At Springbrook, on the acid, low-phosphate, clay loam soils, superphosphate applied at 4 cwt. per acre to white and red clovers increased green fodder yields

from 7.8 to 12.2 tons per acre. In the same trial, agricultural lime at 20 cwt. per acre gave a green fodder yield of 10.9 tons per acre.

Grassland fertilizer trials at Millaa Millaa again confirmed the value of applying ammonium sulphate to mat grass/paspalum pastures. A recent yield trial showed a yield increase from 2.84 to 5.04 tons per acre per annum by the application of 3 cwt. of ammonium sulphate.

Lucerne fertilizer trials at "Eulogie Park," west of Rockhampton, demonstrated that lucerne is capable of producing in excess of 9 tons of air-dry hay per acre per annum in this environment. Over a 12 months' sampling period on this trial, no significant increase to a wide range of major plant foods and trace elements was shown.

Buffel grass growth studies conducted in pots with soil obtained from cypress pine sandridge country at Cecil Plains yielded the following results:—

Treatment	Yield (Grams Oven-Dry Matter per Pot)
Control	1.01
Zinc	1.79
Copper	2.07
Manganese	2.15
Zinc + manganese	2.97
Copper + manganese	3.18
Copper + zinc	3.42
Copper + zinc + manganese	3.94

In this trial, copper-deficient plants were almost white, while plants suffering the triple deficiency ceased growth at about the fourth week.

Regrowth of Biloela buffel grass on this soil type in the field, in plots which had been fertilized two years previously with 3 cwt. of a 5:13:5 fertilizer per acre, showed a chlorosis similar to that of copper-deficient plants. This symptom, coupled with the virtual cessation of growth at a height of 12–15 in., suggests that the micro-nutrient deficiencies are significant in the field. It is not known how general the macro-nutrient and micro-nutrient deficiencies are throughout the whole cypress pine belt, but the evidence helps to explain the inability of buffel grass to persist or spread in some sections of this country.

Pasture Establishment

Detailed investigations on pasture germination and establishment continued on the heavy black soils of the Darling Downs. The temperature behaviour of Rhodes grass, green panic and Queensland blue grass was studied in the laboratory. In brief the findings were these:—

(1) The germination of Rhodes and green panic is not restricted by high temperatures, but it may be restricted by constant low temperatures during continuous rain.

(2) The emergence of these grasses may well be restricted at high temperatures by killing of the tender shoot in contact with hot surface layers.

(3) In the blue grass, on the other hand, rapid germination is confined to a narrow and fairly low temperature range. Moreover, under any one set of germinating conditions, emergence does not occur to a greater extent than one-third of the viable seed. This important factor of delayed germination enables Queensland blue grass to establish itself satisfactorily during seasons in which sowings of the other two grasses may fail completely.

(4) While high temperatures in themselves do not restrict germination of Rhodes grass or green panic, such temperatures may lead to inhibition of germination from microbiological causes. Queensland blue, on the other hand, appears insensitive to such effects. The extent to which this microbial inhibition is operative in the field is the subject of intensified work at the present time.

The technique of establishing pastures by direct sowing into standing wheat stubble is being examined at Jondaryan. These investigations have reached the stage where field-scale demonstrations to test the effectiveness of aerial sowing of Rhodes grass into standing wheat stubble are projected for the summer of 1960-61.

"Brian Pastures" Pasture Research Station

Some 50 pasture projects are in progress at "Brian Pastures" Pasture Research Station, near Gayndah, and increased attention is being given to fundamental aspects of pasture management and legume nodulation studies.

In the major grazing trial, total live-weight gains per acre over the 5-year period 1955–1960 from three pastures based on lucerne were as follows:—

Green panic + lucerne	472 lb.
Buffel + lucerne	469 lb.
Rhodes + lucerne	399 lb.
Native pastures	178 lb.

The grazing intensity on the native pastures was fixed at one-half the intensity of the sown pastures over the period of the trial. Productivity decreased in 1959 due to the decline in the lucerne population following heavy stocking in a drought year.

In the native pastures management trial, stock growth and changes in the botanical composition of the pastures were measured. Animal liveweight gains on native pastures resulting from different systems of pasture management and a uniform stocking rate of 1 beast to six acres are shown in Table 3.

TABLE 3

ANIMAL LIVEWEIGHT GAINS ON NATIVE PASTURES AT "BRIAN PASTURES", 1958-1960, IN LB. PER HEAD

Treatment	21/11/58–19/11/59	20/11/59–5/5/60	Total
Intensive Grazing	26	152	178
Rotational Grazing	97	180	277
Continuous Grazing	94	264	358
Chisel Plough Renovation	109	289	398
Supplementary Winter Lucerne	240	245	485

Applications of nitrogen and sulphur to old green panic pastures growing on self-mulching soils of basaltic origin again substantially increased growth. When a basal dressing of sulphur was applied, the total yield response for the period March 1959 to March 1960 was of the order of 100 lb. dry matter per acre for each pound of nitrogen applied up to a level of 120 lb. nitrogen per acre. A feature of the results was that the contribution of native grasses was inversely proportional to the amount of nitrogen applied.

Carrying more grass in the paddock than is necessary to intercept all the sunlight can be expected to reduce the growth rate of pasture. Results indicate that this condition will occur in dryland green panic pastures only for short periods of the year under high-nitrogen conditions. Complete light interception did not occur until a yield of 6,000-7,500 lb. dry matter per acre was recorded. At this yield the leaf area index was 3.5-4.0 (i.e. 3.5-4.0 sq. ft. of leaf surface supported above each square foot of ground surface). Maximum leaf area index was 7.4 at 10,500 lb. dry matter per acre.

Legumes were grown in large boxes with one sloping glass wall to observe the effect of different degrees of defoliation on nodulation and root growth. In the three species being studied, the increase in volume of visible nodular tissue is inversely related to the severity of defoliation. Under the particular conditions of the experiment, the early flowering *Phaseolus atropurpureus* showed the fastest rate of increase in nodule volume during the first two months after sowing. In the third month centro and *Glycine javanica* showed superior nodule growth rates.

In a joint project with officers of the Chemical Laboratory, the reaction of buffel grass and green panic to different cutting schedules was measured over a period of 21 months. Seasonal trends in percentage reserve

CENTRO, THE TROPICAL PASTURE LEGUME, MOVES SOUTH

Plate 24.—Even in the subtropical environment of the Maroochy district, centro shows it can reach the treetops if protected from stock.

Plate 25.—Centro and molasses grass pasture mixture on steep hillside in the Maroochy district.

CONTINUING THE LEGUME STORY

Plate 26.—Stylo and guinea grass in a farmer's trial in the Gympie district.

Plate 27.—Glycine mixed with green panic on Kairi Regional Experiment Station on the Atherton Tableland.

carbohydrate of the roots and stem bases showed a sharp decline in spring, a further decline in midsummer, and an increase during the maturation period. The rate of accumulation of energy reserves in the storage organs was positively related to plant growth rate.

Buffel grass had a consistently higher percentage content of reserves in the storage organs and much larger storage organs than green panic. Contrary to expectations, the percentage carbohydrate content of the roots and stem bases of the frequently cut plots was usually not lower, and was often higher, than in the infrequently cut series. However, the size of the storage organs and hence the total amount of carbohydrate stored were less in the frequently cut plants.

Buffel grass differs from green panic in its effect on soil structure. The apparent density of the 9-21 in. layer was significantly less in the soil growing buffel grass than in the soil growing green panic.

SOIL CONSERVATION

During the year 1,577 landholders requested technical assistance in the resolution of their erosion problems. The fact that 1,151 of these requests referred to an extension of existing farm soil conservation programmes provides a measure of the appreciation of the Department's service and of the satisfactory results of practices previously applied. However, ultimate progress depends on a wider adoption of soil conservation principles and it is satisfying to record that a further 426 farmers made a start in applying soil conservation practices on their properties.

To meet these requests for technical assistance 16 soil conservation extension officers travelled 93,449 miles in making 3,356 visits to farms for the purpose of preparing farm plans, surveying sites for earthworks, or advising on other aspects of erosion mitigation. The farm visit provides the personalised service so necessary in soil conservation work and there is no adequate substitute for this type of extension effort. Due attention was given to the use of mass media to stimulate interest and to outline general principles. Seventeen field days, schools or inspection tours were conducted, 41 radio talks given and 41 press articles released. Sixty-three lectures were delivered and four show displays prepared.

Runoff and Erosion Control Works

Seventy thousand chains of protective earthworks were installed on 18,158 acres of cultivated lands during the year. The area of the State's cultivated land protected from destructive runoff flow now totals 91,500 acres, or about 8 per cent. of the area estimated to require this type of protection at present. When related to available staff, very satisfactory progress can be claimed for all districts, but the Burnett district is outstanding with 9,950 acres of cultivated land protected during the year, this being 1,300 acres more than in the previous year.

In Central Queensland, where it is hoped that less intensive systems of mechanical control works will be required, 1,440 acres of land were surveyed for contour strip-cropping. The value of this method will not be known for some years.

Stable water disposal systems are an essential part of any soil conservation scheme. Over 6,600 chains of artificial waterways were constructed during the year. On the Darling Downs 2,100 chains required immediate stabilisation with kikuyu grass. A mechanical sprig planter was used on 39 waterways and on the remainder ploughs were used to open furrows in which the grass sods were planted. There seems little doubt that the planting of sods in plough furrows gives very much better results than the planting of lacerated sprigs by the sprig planter.

Planning

Significant progress in the consolidation of planning procedures was made. Special attention was devoted to this aspect on the Darling Downs, where a much more detailed system of planning and designing conservation systems has been adopted. The whole area is now being mapped in terms of watershed and catchment subdivisions and group plans are being developed for natural drainage communities. This has had an immediate effect in stimulating co-operative action on the part of farmers and has facilitated the integration of farm water disposal systems with cross-drainage structures on public utilities.

Catchment planning was initiated in the South Burnett and Atherton districts some years ago and the fruits of this work are now seen, particularly in the South Burnett, where interest in soil conservation continues at a high level. This approach has now extended to the Central Burnett, where the new Gurgeena catchment project is moving smoothly.

Catchment planning requires the rapid and accurate development of base plans on a scale of 10 chains to 1 inch. These plans provide the basis for the plotting of topographic and planning data. The improvement in grid integration techniques and the utilisation of episcopic projection methods during the year enabled a remarkable increase in the rate at which the base plans can be produced. Whereas base plans were developed for 150,000 acres in 1957-58, this figure increased to 550,000 acres in 1958-59 and in 1959-60 to 1,100,000 acres.

Good progress was made in the preparation of complete soil conservation plans and planning was finalised for 172,000 acres during the year. This compares with an area of 50,000 acres for the previous year. Plans issued to farmers totalled 197, covering an aggregate area of 83,000 acres.

The plotting of topographic information is a time-consuming bottleneck in plan preparation and steps were taken during the year to utilise the photogrammetry services of the Survey Office in plotting contours on an area of 180,000 acres of the Darling Downs.

Investigations

On the Darling Downs the investigational work was confined mainly to an examination of further aspects of the problems of establishing kikuyu grass in waterways and gullied areas. As a result this work is now virtually complete and the programme has entered the demonstration phase.

Last year it was established that the emergence of kikuyu grass was stimulated by spraying the soil surface with asphalt emulsion. Trials in the past year showed that optimum results are obtained when the emulsion is applied at the rate of 1 gal. per sq. yd. Following this treatment, 45 per cent. of the ground surface was covered by grass in three months, whereas in the unsprayed soil treatment only 15 per cent. of the surface was covered. At the end of four months the ground cover in the asphalt emulsion treatment had reached 95 per cent. and in the control 82 per cent. The application of a thin layer of straw mulch to the soil prior to spraying was found to have a retarding effect on colonisation. The colonisation for the 1 gal. per sq. yd. application over mulch was 10 per cent. at three months and 77 per cent. at four months.

A separate line of investigation showed that late winter plantings of kikuyu grass colonise successfully where the asphalt application is made, due to a substantial increase in soil temperatures in the 0-1 in. soil layer and to a retardation of soil moisture losses through evaporation. In one test the soil moisture at the 2 in. depth was 49.3 per cent. under asphalt emulsion and only 32.2 per cent. with the normal soil surface.

Compaction trials showed that sprigs planted 3-4 in. deep and compacted by rolling provide the most satisfactory conditions for establishment.

Trials in waterways under conditions of existing flow showed that where an immediate major flow with velocity of up to 10 ft. per sec. may be expected the area should first be sodded with kikuyu grass in strips 1-2 ft. apart, the strips to run at right-angles to the direction of flow. The whole area is mulched with straw to a depth of approximately one inch, then covered with netting, which is pegged down, and an asphalt emulsion spray applied at the rate of ¾-1 gal. per sq. yd.

It was shown that for smaller waterways, where minor flows are expected, safe flow conditions can be provided and the growth-retarding effect of the mulch avoided by placing the mulch and netting between the kikuyu grass strips, and the whole area is then sprayed with the asphalt emulsion.

In the South Burnett, investigations were initiated for the purpose of determining the hydraulic behaviour of a typical kikuyu grass waterway. Tests so far completed have indicated that this grass if allowed to grow rank may result in a much higher retardance to water flow than was formerly considered to be the case. This work is continuing.

General

The Advisory and Co-ordinating Committee on Soil Conservation met once during the year and was able to assist in promoting greater co-operation between Government Departments with respect to soil conservation. The District Soil Conservation Committees which were formed last year met a number of times and provided constructive approaches to difficult problems in liaison.

SOUTH JOHNSTONE EXPERIMENT STATION

The total rainfall at the Station during the year was 133 in., which is slightly in excess of the 25-year average precipitation of 120 in. Cool, wet and cloudy weather conditions up to the middle of September were unfavourable for pasture growth. With a return of sunny days, and the onset of warmer weather in November, improved pasture growth occurred.

Tropical Pastures

In the grazing management trial at South Johnstone, rotational grazing of guinea grass, para grass, calopo and centro pastures is being compared with continuous grazing. Despite difficulties in handling this year's bullocks, liveweight gains per acre were most encouraging (Table 4). At this stage it cannot be claimed that rotational grazing offers material benefits when a stocking rate of 1 beast per acre is employed.

TABLE 4

LIVEWEIGHT GAINS IN POUNDS PER ACRE AT SOUTH JOHNSTONE

Treatment	Grazing Period (253 days) 3/3/59–11/11/59	Grazing Period (155 days) 21/12/59–31/5/60	Total 408 days
Rotational Grazing	123	356	479
Continuous Grazing	190	342	532

The continuous grazing trial at Utchee Creek provided further information on the productivity of various tropical pasture mixtures. Fractious animals to some extent were responsible for the lower levels of beef production recorded during 1959. Weight gains for three consecutive years are shown in Table 5.

TABLE 5

LIVEWEIGHT GAINS IN POUNDS PER ACRE AT UTCHEE CREEK

Mixture	Period 1/6/57–30/4/58	Period 1/6/58–30/4/59	Period 1/6/59–31/5/60
Guinea/Centro	250	215	395
Guinea/Puero	191	195	272
Para/Centro	228	245	353
Para/Puero	147	196	279
Molasses/Centro	173	120	216
Guinea/Molasses	165	104	168
Para grass	148	97	156

At South Johnstone, *Brachiaria decumbens* was submitted to continuous grazing, and during the period May 1959 to May 1960 average weight gains per animal fluctuated between 1.38 and 2.58 lb. daily. This grazing trial confirms the opinion that further work is justified to exploit the potential of this pasture plant.

A trial to compare the yield and palatability of recently introduced strains of *Paspalum plicatulum* and *Setaria sphacelata* provided useful data. These new introductions outyielded pangola grass, purple-top guinea grass and para grass throughout the season, but are not necessarily more palatable. *Paspalum plicatulum* requires heavy grazing or mowing to keep the rank growth short and palatable, while *Setaria sphacelata* is coarse and not readily accepted by stock.

Tea

The extension of the 1959 monsoonal season till the end of August proved particularly beneficial to the tea plantings, especially the hedges, which had been pruned in April-May 1959. Regeneration was rapid and very few bushes were lost. The hedge plantings were mechanically plucked throughout the year and a fertilizer trial laid down to examine the effects of different treatments. This trial will be continued during the life of the hedges and plucking figures will be examined annually for treatment differences.

Miscellaneous

Lantana regrowth spraying trials using 0.2 per cent. 2,4-D ester with 0, 1 and 2 per cent. of added distillate were carried out on lantana showing regrowth 12-15 in. high. In one trial the sprays had a negligible effect; in another trial kills of the order of 90 per cent. were obtained, irrespective of the percentage of added distillate. The difference in these results is ascribed to the higher air temperature (near 100 deg. F.) prevailing when the first trial was established, as compared with 80-85 deg. in the second trial.

Spraying of guava regrowth with 0.2 per cent. 2,4-D ester or 0.2 per cent. 2,4,5-T appears to result in root sucker development and the method may have little practical value. The possibility of controlling guava by guinea grass and fire is also being examined.

FODDER CONSERVATION

An interesting form of portable silo of approximately 40 tons capacity has been under trial at Moggill for two seasons. Basically, this silo consists of a self-supporting circular frame of arc-mesh 20 ft. in diameter and 7 ft. high, which is lined before filling. The original lining tested was heavy tar paper, which proved quite satisfactory for short-period storage, though it was easily punctured. Lighter grades of tar paper were subsequently tried.

Tests of thin ($\frac{1}{8}$ in.) tempered pressed wood sheets were subsequently made, and the present indications are that this material, though highest in first cost, will prove most economical in the long run. Its main features are durability in use, availability for repeated use, and provision of reasonably airtight storage. Both the lining materials and the arc-mesh frame may be moved if necessary when the silo is emptied.

In order to obtain the most ideal sealing against air entry and to reduce the number of lap joints, it appears preferable that the tempered pressed wood sheets used should be cut to 7 ft. lengths and stood vertically inside the arc-mesh frame, so that the only laps are simple and vertical. At the door-way, half-width sheets are more easily drawn up to allow feeding out.

The fodder stored behind the pressed wood lining this season was fed out in June 1960, and proved extremely palatable. Fodder from three different paddocks was stored in layers in this silo and the analyses (Table 6) are of interest, particularly in regard to protein content.

TABLE 6

ANALYSES OF SILAGES FROM ARC-MESH SILO

——	No. 1 Maize	No. 2 Lucerne/Summer grass	No. 3 Lucerne/Green Panic/Rhodes
	%	%	%
Crude Protein	5·4	9·1	10·0
Fat	1·6	1·6	1·8
Fibre	33·3	38·5	38·4
Carbohydrate	54·0	42·0	40·5
Ash	5·9	8·8	9·3
CaO	0·37	·85	0·91
P_2O_5	0·72	1·05	·98

This form of aboveground silo has been shown to be effective where space is at a premium close to feeding-out areas. It requires some form of filling elevator, and manual spreading and trampling are unavoidable.

AGRICULTURAL ENGINEERING

The advisory service in agricultural engineering was maintained throughout the year and close liaison with machinery manufacturers and distributors continued.

The problem of heavy implement draught due to poor scouring and soil pick-up of press wheels under sticky soil conditions engaged the Department's attention. The unusually low friction of polytetrafluoroethylene at low speeds and the high wear resistance of nylon have been responsible for wide applications of these plastics in industry. In order to test out this type of material the co-operation of a Sydney firm was sought and a small press wheel on a seed planter has been nylon coated for soil adhesion and abrasive tests on the Darling Downs.

The development of a rainfall simulator for soil conservation research will enable valuable data to be obtained on infiltration, runoff and soil loss. Certain modifications have been made to an American design to facilitate transport, and in general, meet with particular local requirements.

HORTICULTURE BRANCH

A significant feature of horticultural development was the near-completion of the Food Preservation Research Laboratory at Hamilton, Brisbane, at an estimated cost of about £130,000 including equipment. The laboratory covers an area of about 10,000 sq. ft. and will provide essential facilities for intensifying research on the storage, transport and preservation of our major horticultural crops.

In the field, the most notable advance was the completely new fertilizer programme for pineapples, which reduces the cost of material used by approximately 50 per cent. Production methods in bananas have also changed following investigations on plant spacing, types of planting material and methods of setting followers for the ratoon crop. The major advance in vegetable crops was the strong demand for new bean varieties bred at the Redlands Experiment Station. Steps were taken to improve facilities at the two main research centres, Redlands Experiment Station and Maroochy Experiment Station.

The general recession in price levels for most fruits and vegetables added to the responsibilities of the extension staff, as expert judgment is needed to curtail operational expenditure without reducing farming efficiency.

Regulatory services had to be strengthened to cope with the greater imports of quarantinable material entering Queensland, particularly from China and Japan, and to ensure that the horticultural products leaving Australia are of export quality. Exports of apples to the United Kingdom from Queensland, about 105,000 cases of Granny Smith applies, reached a record level.

RESEARCH PROJECTS

Pineapples

Recent investigations promise to bring about a complete change in current fertilizer practices. Traditional methods of fertilizing the crop by side-dressings have been shown to be less effective than fertilizer schedules in which the total phosphorus and potassium requirement is incorporated in the soil before planting and nitrogen is supplied at 2-monthly intervals in the form of urea sprays. The new schedules reduce expenditure on both raw materials and labour.

Crop management studies in Central Queensland indicate that plant development in this region follows much the same pattern as in southern Queensland. Some problems of growers in the area appear to be due to a preoccupation with large fruit, rather than with maximum tonnage per acre-year. Production methods are being varied accordingly, and should result in more profitable use of the available land.

Indifferent results with flower induction in Central and North Queensland may be associated with climatic conditions and growth rates in the crop. Standard ANA or carbide solutions are not altogether satisfactory. Current trials indicate that optimum results can be expected from the use of a solution containing both ANA and carbide. Time of application is important; better results were obtained from treatment early in the morning than at other times of the day.

Pineapple clones selected for propagation in 1950 provided sufficient material for the establishment of comparative trials at the Maroochy Experiment Station in 1958. Differences in both yield and fruit quality were recorded. High yields, however, were not correlated with flesh quality, and choice of particular clones for commercial propagation will therefore depend largely on cannery policy.

Rough-leaved pineapples are the subject of investigations at the Kamerunga Station and at Ayr Regional Experiment Station. The available material is somewhat heterogeneous and some strains are being bulked for use in field trials.

The quality of canned pineapple in Queensland is usually better in the summer than in the winter crop, due to a higher sugar content, greater concentration of flavouring constituents and a better colour. These characteristics are reflected in the juice extracted commercially from pineapple residues. Random samples of juice taken from commercial production lines are therefore being examined over a period of 12 months for sugar, flavour and colour. Such information will be invaluable in the proposed experimental work on the concentration of pineapple juice which will be commenced immediately a special turbulent film evaporator with ester recovery equipment designed for the Hamilton Laboratory becomes available. In overseas countries consumption of fruit juices has been stepped up considerably by concentration equipment which not only retains the natural flavours of the juice but reduces expenditure on transport and storage. The experimental unit designed for Hamilton will be the first of its kind in Australia.

The appointment of a microbiologist has enabled work to be commenced on the bacterial count in canned fruit products in order to determine the efficiency of the various methods now being used by Queensland canners. Cultures obtained from the Australian Wine Institute are being used in experimental work on the production of wine and vinegar from pineapple juice not suitable for canning or bottling.

Bananas

The Cavendish variety contains a series of plant types which differ in size, bunch and fruit characters. Five types are now under test at the Maroochy Experiment Station. Should these differences prove significant, the best plant type will be propagated for commercial production. Similar work is planned for the Mons Mari and Lady Finger varieties.

Fertilizer practices in the banana are largely based on empirical data. A trial at the Maroochy Experiment Station showed no marked differential response to added nutrients. This suggests that methods of applying fertilizer on sloping ground need investigation; loss of nutrients in surface runoff and drainage water may be excessive.

In North Queensland, yellow-leaf symptoms are common after each wet season; they are transient and affect bunch size but sucker growth is normal. Current work at Innisfail suggests that temporary deficiencies of available potassium and magnesium may be involved.

Various methods of desuckering were checked. Injury to the parent plant following desuckering can have a considerable effect on bunch size and the development of the follower. Cutting the sucker and applying

kerosene to the cut surface was the most efficient treatment. Suckers should be at least three inches in base diameter before removal; if peepers are treated, translocation of kerosene to the parent corm may take place.

The possibility of exporting bananas to Japan, which formerly obtained its supplies from Formosa, is now under investigation, and trial shipments from Brisbane are being planned. Previous experiments have shown that bananas have a storage life of about three weeks at 53 deg. F. and a further life of about one week at atmospheric temperatures. While this should be sufficient to enable bananas to be exported to Japan, some difficulty may be experienced in maintaining this temperature accurately on shipboard. Experiments are therefore being conducted to determine the storage life of bananas over a range of temperatures, for temperatures below 53 deg. F. may cause chilling while temperatures above this range will accelerate ripening.

Papaws

Lack of response to fertilizers in a papaw nutritional trial was reported last year. In the second crop marked responses were recorded from applied nitrogen. There is normally a marked disparity in fruit size between the first and second crops, and this is not readily correlated with seasonal conditions. Frequent applications of nitrogen to the second and subsequent crops may therefore be desirable.

Weedicides are seldom used in papaws, as spray drift may be injurious to the plants. However, the labour commitment in controlling weeds is heavy and an efficient weedicide is needed. Of those available, the best is probably monuron, which gave effective control of broad-leaved weeds and reasonable control of grasses in pre-emergence studies at the Maroochy Experiment Station. Current prices for this material are high.

Markets for papaws are normally buoyant in autumn and early winter. The shortage of fruit at this time of the year reflects the difficulty of getting a good set of fruit in spring, when soil moisture levels are often low. Hormone treatments of the newly set fruit may be useful, and current work at the Maroochy Experiment Station is concerned with studying the effect of ANA and 2,4-D sprays.

Most strains of papaw grow too tall for efficient harvesting after the production of the second crop. Methods of training trees are under investigation at the Maroochy Experiment Station. The aim is to promote branching early in the life of the tree so that the crop can be harvested from two or three branches at a reasonable height rather than from a single trunk.

Experimental packs prepared by Departmental officers from the Guinea Gold variety grown in the Yarwun district have led to the installation of a quick-freeze plant at Gladstone and the export of frozen papaw to southern States. It is proposed to send trial samples to Canada and the U.S.A. for trade reports. The papaw is one of the main ingredients of fruit salad but the canners are dependent mainly on supplies of large fruit, for which there is a limited outlet on the fresh fruit market. Experimental work is to be undertaken with some of the main varieties of papaws picked at various stages of maturity in order to determine whether any improvements can be effected in commercial packs.

Citrus

Citrus trees needed for stock-scion trials in the various districts were produced at the Redlands Experimental Station and at Gayndah. One trial has already been set out, and the balance is scheduled for planting in the spring of 1960. These trials include all the more important commercial varieties on a range of rootstocks. Tree performance in these trials should give precise information on stock-scion behaviour over a range of soil types.

Nucellar trees at Gatton Regional Experiment Station are now bearing. Valencia Late orange, Joppa orange and the Villa Franca lemon, however, are particularly vigorous and produced fruit at an early age. The Glen Retreat mandarin progenies failed completely in their third year following root rot infection, a disease to which the variety is notoriously subject. It is hoped to use some of the Gatton material to establish blocks of trees in producing districts as sources of the budwood required by the Citrus Budwood Distribution Scheme.

Seed viability studies were carried out in collaboration with the Standards Branch. It appears that loss of viability in sweet orange seed is due to excessive drying after extraction from the fruit. Drying should cease once the seed can be handled with reasonable ease. From then on further loss of moisture should be prevented by the use of polythene wrappers.

Mould wastage in citrus fruits frequently occurs during artificial colouring and also during storage. The normal method of controlling this wastage by fungicidal dips or wraps cannot be applied prior to colouring as the fruit must be gassed as soon as possible after picking. The possibility of injecting a gaseous fungicide such as ammonia or nitrogen trichloride into the ripening rooms has been investigated on a commercial scale at Mundubbera. For this purpose special equipment had to be imported from overseas, as the concentration of gas used must be carefully controlled to avoid possible injury to the fruit. Both gases gave good control of mould wastage during ripening but nitrogen trichloride retarded the ripening process. The effect of these gases in controlling mould wastage during storage was also investigated. Good control of wastage was achieved; ammonia is the more satisfactory gas to handle as nitrogen trichloride is extremely corrosive. Consideration is being given to designing a simple ammonia injector which can be used in the majority of citrus colouring rooms in Queensland.

Avocadoes

Tree performance in stock-scion trials at the Redlands Experiment Station is generally satisfactory. Some of the scion varieties under test are of only limited value because they either produce light crops or mature their fruit at periods of the year when better varieties are available. These trees will be worked over to new varieties. Current indications are that stock type does not matter a great deal provided the stock itself is vigorous. Scion varieties with good quality fruit, reasonable productivity and maturing in succession from April to November are Fuerte, Sharwill, Nabal and Hass. The last of these could become very important to the industry.

Propagation methods developed at the Redlands Experiment Station are attracting the attention of nurserymen. Current practice is to plant the seed in soil enclosed within tarred paper tubes about 10 in. long and 4 in. in diameter. Cleft grafting is practised in place of the conventional tip and side grafts. With this method of propagation, the period from planting to transplanting in the orchard is reduced to approximately 12 months.

The quality of some of the more recent American introductions has been evaluated, and the Wright variety shows promise as an early variety. Experiments have also shown that an oil content of not less than 10 per cent. for Anaheim, 12 per cent. for Nabal and 15 per cent. for Ryan, Hass and Sharwill may be suitable maturity standards. A minimum oil content of not less than 15 per cent. is now prescribed for the Fuerte variety. Interesting results have been obtained with the Ryan variety, which has failed in previous years to ripen normally when picked later than August. It has been noted that the stage of growth of the tree when the fruit is harvested can affect ripening results. A physiological disorder known as ringneck which occurs during maturation has been observed for the first time in Queensland avocadoes, and the presence of this disorder can accelerate ripening off the tree. Information being collated from a questionnaire forwarded to growers should provide useful information on avocado varieties, tree age and rootstocks now in commercial production in Queensland.

Macadamia Nut

Seedling trees in the stock-scion trial at Rockhampton will be grafted in spring with scion wood from Maryborough. The trial is expected to indicate refinements in

techniques which could place Macadamia tree propagation on a commercial basis. The steady demand for processed nuts indicates considerable scope for expanded production. Grower awareness of the potentialities of the crop have been emphasised by visits from Californian horticulturists, and sizable plantings can be expected in the near future. Techniques of grafting and top working have therefore a high priority in current programmes on the North Coast.

The processing plant at Murwillumbah, where the major portion of the Queensland crop is processed, has been improved by the installation of additional grading and cooking equipment. Previous work indicated that Macadamia nuts cooked in coconut oil were superior in flavour to the oven-roasted product mainly because of their more uniform colour and more oily flavour. There is a possibility, however, that the cooking oil may be conducive to staleness and rancidity, particularly if sales are unduly delayed. This point is now being investigated experimentally, using a special rotary oven which maintains uniform temperatures during cooking.

Custard Apple

There is little to report from the stock-scion trials of custard apples at the Redlands Experiment Station. Some trees commenced to bear but others are still in the vegetative stage. One of the rootstock species has an attractive, pink-fleshed fruit which is too seedy to be of commercial value. A similar type with fewer seeds is grown in India, and steps have therefore been taken to procure scion wood for use in Queensland.

The pond apple, which showed promise as a stock for custard apples, proved a disappointment. Grafts took well on this stock and made very good growth for a period of six months or so. Shortly afterwards the scion material collapsed, presumably because of an incompatability between stock and scion.

Deciduous Fruits

The soil management trial initiated at Stanthorpe in 1959 is now well established. In plots which were mulched heavily with straw, leader growth was substantially better than in other treatments. This probably reflects a more stable soil moisture level in the mulched plots in late February and early March when conditions were rather dry.

Fertilizer trials have been established on a range of soil types in an attempt to elucidate current nutritional problems. In one trial where an apparent response to high potassium has been recorded, treatment schedules were altered to determine the effect of frequent applications of nitrogen during the growing season.

Measles is a common trouble in apple orchards at Stanthorpe, particularly in the variety Delicious. Normally, it can be corrected by the application of boron sprays but responses are not consistent in young trees. Manganese toxicity produces comparable symptoms in other States and is listed for investigation.

Some years ago, DNOC (0.06 per cent.) was released for commercial testing as a chemical thinner for plums at Stanthorpe. A survey of current practice indicates that many growers prefer sprays with a higher concentration. A further trial during the year did not provide any evidence that concentrations higher than that originally recommended should be used. In this trial, chemical thinning improved fruit size, but net returns to the grower were not increased. This is probably normal in a season such as 1959-60, when soil moisture during the growing period was adequate for the needs of the plant. There is some evidence that old trees are more effectively thinned by DNOC sprays than young trees; this could have a bearing on the use of high-concentration sprays by some growers.

Storage trials with diphenylamine (DPA), which has given good control of superficial scald in Granny Smith apples over a number of years, were continued with a view to determining whether (*a*) control of scald could be achieved over a wide range of pickings, (*b*) smaller concentrations of DPA could be used if incorporated in mineral oil wraps, and (*c*) DPA could be removed by solvents after storage, thus overcoming any health hazard. Results showed that treated fruit can be picked as early as the third week in February, if it is to be stored under normal conditions, and in the third week in March, if stored in an artificial mixture of carbon dioxide and oxygen. However, this early-picked fruit developed severe internal discolouration during storage. This disorder was not apparent in fruit picked about three weeks later in each case. Experiments also showed that while lower concentrations of DPA could be used if incorporated in mineral oil wraps, the DPA could not be removed from the skin by solvents.

While the use of DPA will improve methods of storing Granny Smith apples in the Stanthorpe district, it cannot be recommended commercially until cleared by the health authorities. Nineteen other compounds of somewhat similar composition to DPA were therefore tried, and a proprietary compound known as "Santoquin," which is an accepted treatment for stock food, gave results equal to those obtained with DPA.

Work will be continued in 1960 with this substance together with other substances of similar composition but with less toxic properties. Work on the estimation of beta-carotene, which appears to be associated in some way with scald development, has been held up pending the finding of a suitable method for its extraction from apple skins. Semi-commercial trials have shown that controlled atmosphere storage will extend the cool-storage life of Granny Smith apples provided the apples are picked at the right stage of maturity and are in a sound condition. This method has been tried in Stanthorpe on a commercial scale with some success.

Pears

W.B.C. pears are used as an ingredient in canned fruit salad, which contains a large proportion of pineapple. Canners prefer to process the pears during the summer pineapple season, and supplies of this fruit are normally obtained from New South Wales. This fruit is of good quality and ripens uniformly. By comparison W.B.C. pears from the Stanthorpe district have shown extreme variability in ripening and canning quality. Experiments conducted in the past season showed that W.B.C. pears picked in February, stored immediately at 30 deg. F. and subsequently held at a constant temperature of 65 deg. F. will keep sufficiently long for canning requirements and will ripen uniformly to a good canning quality. Many of the difficulties experienced in the past were due to a lack of knowledge by growers of storage and canning requirements.

Passionfruit

The passionfruit breeding programme is designed to select plant types from progenies derived from *Passiflora edulis* x *P. flavicarpa*. Some of the lines now available are reasonably uniform, crop well and produce fruit which is superior to that of the common *P. edulis*.

Strawberries

In a varietal trial conducted during 1959, Majestic (a new type introduced from Palmwoods) proved inferior to the standard variety Phenomenal. The latter variety does not give a satisfactory frozen pack because of its soft texture. The Majestic variety, however, has a much firmer texture and shows promise as a processing berry. Extreme variability in size and quality were observed in experimental samples obtained from the Redlands Experiment Station in 1959. The variety may, however, prove useful on very light sandy soils where its characteristic vigour could be an asset.

Time of planting and mulching materials were further investigated at the Redlands Experiment Station. Late plantings produced a small bush with few crowns and a relatively light crop. The peak harvest period was much the same irrespective of time of planting, the bulk of the crop being picked in August and September. Plastic mulch proved superior to the tan-bark mulch normally used by growers.

The cost of controlling weeds in the strawberry crop is high, particularly in the heavier clay loams. Of several weedicides under test at the Redlands Experiment Station, SES (sodium 2,4-D ethyl sulphate) was the most promising. Treatment prior to planting effectively suppressed weeds for a period of six weeks. Commercial trials are now under observation.

Mangoes

Further investigations on maturity standards confirmed those of previous years that a total solids content of not less than 15 per cent. for the Kensington type and not less than 11 per cent. for varieties other than the Kensington type are satisfactory maturity standards for mangoes. Such standards are now prescribed by Regulation.

The possibility of using common mangoes for juice manufacture was investigated with fruit grown in the Townsville district. The extracted juice contained a considerable amount of suspended material which holds the flavouring constituents; this, unfortunately, is removed when the juice is clarified by centrifuging. Further work will be undertaken when special equipment for juice clarification and concentration is installed at the Hamilton Laboratory. Samples of quick-frozen Kensington mangoes prepared by Departmental officers for a Queensland processor resulted in the installation of a quick-freeze plant at Gladstone and the development of an export trade to southern States. The quick-frozen stringless mango is rated superior to other frozen fruits because of its excellent flavour, attractive colour and ability to retain its firm texture after thawing. Large-scale plantings of mangoes in Central Queensland are now under consideration.

Ginger

Sawdust has been used extensively in the ginger crop for the control of weeds and to conserve soil moisture during the growing period. In 1959-60, the merits of clear plastic mulch as a substitute material were investigated. The plastic mulch increased soil temperatures in spring and promoted early shooting, which could be an advantage in some seasons.

The commercial methods of processing ginger in Queensland conform in general to those established by Departmental officers experimentally. Research in the past season was concerned with comparing various coating substances, mainly of a gelatine base, with a view to preventing weeping under high humidity.

Tomatoes

An F1 hybrid derived from Q2 x Salads Special may find a place in the winter cropping programme in southern coastal Queensland. It performed well in a May planting at the Redlands Experiment Station. Seed of the hybrid is not commercially available, but growers are producing their own seed, and commercial plantings will be made during 1960.

Nutritional investigations continued at the Redlands Experiment Station. Abnormalities in growth are rather widespread and they could be due to imbalance of the major plant foods. Recent glasshouse and field trials indicate that at least part of the response associated with applications of superphosphate to soils already well supplied with this nutrient is due to sulphur in the fertilizer. The relationship, however, is not a simple one.

The disorder known as crease-stem is being investigated at the Redlands Experiment Station. Mild symptoms have little effect on growth or productivity but in advanced cases, characterised by splitting of the stem, suppression of terminal growth and strong lateral development, the onset of cropping is delayed and yields are markedly reduced.

Seed extraction techniques used in the certified seed production programme at Stanthorpe have been under review primarily to reduce operational costs. Mechanical methods of removing the pulp with the seeds prior to fermentation have been developed and are now in commercial operation.

The Lady Cunningham variety grown in Bowen is a soft-textured fruit and prone to radial cracking if left on the plant until it is turning colour. Consequently, it has to be picked at a green-mature stage of maturity, and considerable difficulty is experienced by growers in determining the correct stage at which it should be picked for distant markets. The result is that fruit ripens unevenly and arrives in Sydney at various stages of colour. At the request of the Bowen Fruit Growers' Association, experimental work under controlled conditions of temperature and using ethylene as a ripening accelerator is being carried out by Departmental officers to determine whether this variable ripening can be overcome. Results so far are promising, as artificial ripening has resulted in accelerated and more even ripening.

Pulse Crops

Breeding programmes designed to produce bean varieties with the agronomic properties of Brown Beauty plus adequate resistance to important diseases such as rust and anthracnose were continued. The recent releases, Redlands Beauty and Redlands Belle, though in strong demand, have defects and may be superseded by 1212, which is not only a better agronomic type but also carries effective resistance to angular leaf spot. This line is in the final stages of appraisement.

Some stringless bean selections can now be classed as potential commercial types. Pod quality is acceptable and yields are satisfactory. Stringless beans are less tolerant of cool conditions than string beans, and commercial production may be restricted to areas with a favourable climate.

Six varieties of culinary dry bean under test have been released for commercial testing in the Burdekin. They are Black Eye, Coralli, Mandaloni, Borlotti, Saluggia and Rossini. The produce from the crops should give a reasonable picture of the market demand for each.

Pea selections obtained from progenies of Massey x Canner 75 and related types were further purified during the year and are now ready for regional testing. The best of them combine earliness of maturity with heavy yields of pods of above-average quality. They could fill a useful place in the Queensland pea industry.

Cruciferous Crops

Varietal and spacing trials with cabbages were carried out at Stanthorpe during the year. The behaviour of the several varieties used in the trial followed the pattern of earlier trials at the Redlands Experiment Station. The data suggest that closer spacing of Enkhuizen Glory will increase yields per acre and keep head size within the optimum requirement of the markets, viz.: 3-4 lb. On short-supplied markets, a premium is paid for this class of cabbage.

Root Crops

In carrot trials at Stanthorpe, Topweight proved the best commercial type in both yield and head quality. Osborne Park, a variety which was very popular some years ago, gave an indifferent performance mainly because of its susceptibility to root rots and the consequent high wastage in the harvested crop. The contemporary Topweight is an entirely different carrot from its predecessor of the same name; selection over a period of years has shortened the root to a more attractive shape and led to a considerable improvement in flesh quality.

Successional plantings of beetroot varieties at the Redlands Experiment Station indicated that, unlike carrots, all beetroot varieties follow the same growth pattern regardless of time of planting. Early Wonder, as expected, proved the higher yielding type. For maximum yield per acre the optimum time of planting is April-May. When planted earlier or later, plant size and yields decline, and in early summer plantings, yields may be reduced by as much as 60 per cent.

Salad Crops

Nutritional studies in lettuce grown on a podsolised soil at the Redlands Experiment Station gave no response to added nitrogen, presumably because residual supplies from the previous crop were adequate. A marked response to phosphorus was, however, recorded as well as some curious interactions between nitrogen and phosphorus and between phosphorus and potassium. Results are atypical, as this soil type is relatively infertile and of poor structure.

Glasshouse investigations indicate that lettuce stunt, a common disorder in lettuce in the Brisbane district, may be associated with abnormal nitrogen nutrition.

Plate 28.—Water being siphoned out of the head ditch into the top spreader furrow for contour flood irrigation of a pasture at Maleny.

Plate 29.—Precropping a contour ditch irrigation project at Redbank using cowpeas.

In varietal and strain trials with celery at Stanthorpe, local selections of South Australian White yielded better crops than commercial seed from the southern States. In the first of two trials, low temperatures in the seedbed were followed by "bolting" shortly after transplanting. In seedbeds established early in spring, seedling protection with "Windolite" or some similar material is clearly necessary to maintain temperatures above the critical "bolting" level of 60 deg. F.

PROCESSING VEGETABLES

Quick-frozen and canned peas are becoming increasingly popular in Queensland because of their uniformly good quality and the readiness with which they can be served. Supplies are drawn from the southern States, mainly Tasmania. Experimental work has therefore been carried out at Redlands Experiment Station and the Ayr Regional Exepriment Station to determine whether suitable varieties of peas could be grown in Queensland for processing purposes. The results indicate that yields obtained under these conditions compare favourably with those recorded in southern States. More detailed trials will be carried out in 1960.

It is now possible to predict the exact date on which the crop should be harvested for maximum quality. Experimental work will be greatly expedited by the purchase of a viner which enables the crop to be harvested mechanically and the peas to be shelled in one operation.

Technical discussions have taken place with commercial firms on the possibility of manufacturing potato flakes from Queensland grown potatoes, and a pilot plant of commercial size is now being operated in Lowood. It is hoped to obtain essential information on the cost of production of potato flakes and their sales potential in Australia. Further work is to be carried out in conjunction with Agriculture Branch officers to determine whether the specific gravity of a potato, on which the yield of potato flakes depends, is influenced by variety and fertilizer treatments.

TRANSPORT

Fibreboard cartons are being used quite extensively in Australia for the packaging of fruits and vegetables, but little information is available regarding temperature conditions of fruit packed in these cartons and transported over long distances. In order to obtain these data, a trial was carried out in conjunction with the C.S.I.R.O. Division of Food Preservation and Transport, the Bowen Fruit Growers' Association, Australian Paper Manufacturers Ltd., and the Queensland and New South Wales Railways Departments. Fruit temperatures were recorded both in wooden cases and in cartons prior to consignment and during transit from Bowen to Sydney.

The results indicate that in normal solid stowage adopted for wooden cases, self-heating is likely to occur in a fibreboard carton, as the pulp temperature at unloading in Sydney was 4-5 deg F. higher in cartons than in wooden cases. This higher temperature was reflected in the more coloured condition of the tomatoes in cartons as compared with those in cases. The adoption of a more open type of stowage may prevent any significant rise in temperature in fibreboard cartons during transit in the cooler months, but this point requires further investigation. One very important finding of the experimental work was that the temperature of fruit rose 14 deg. F. when the cases were closely stacked and kept for several days in the packing shed prior to transit. This could be a contributory factor to the rapid ripening which often occurs during transit of Bowen tomatoes to Sydney.

PACKAGING

The trend towards bulk handling to reduce manual labour is becoming more evident in harvesting operations in Queensland, and bins holding 50 to 100 bus. of fruit are now replacing the smaller field box for transporting fruit from the orchard to the packing shed. Bulk bins holding about 25 bus. of fruit are being used successfully for transporting apples overseas and to interstate destinations. The bins are designed to fit on a pallet which is loaded by fork lifts or cranes, thus avoiding manual handling. The bins are packed direct from the grader, thus saving packing costs. Elimination of manual handling has completely eliminated bruising. Bulk containers are also being used in Queensland for transporting pineapples to the factory.

A fibreboard carton of telescopic design holding a single layer of avocadoes has proved successful in interstate trials and has now been recommended as a commercial package for this fruit. Other fibreboard cartons under trial include the open bushel type for papaws and an open carton of 1¼ bus. capacity for bananas sold on the local market. A carton of fibreboard construction consisting of a number of fibreboard trays designed to hold a particular size of fruit is being used successfully by Stanthorpe growers on local markets. As it can be packed mechanically it could prove extremely useful in expediting packing-shed operations during the export season, when large quantities of fruit are required over a very short period.

A number of wooden cases are on trial for the packaging of papaws in single layers for local and interstate markets. They include the pear flat case for small papaws, the bushel dump case for large papaws, and a new case of dimensions 21 in. x 14¼ in. x 7½ in. designed by a Yarwun grower for papaws 3–4 lb. in weight.

EXPERIMENT STATIONS

Maroochy Experiment Station

The Maroochy Experiment Station is concerned mainly with research on pineapples, bananas and papaws. However, an attempt was made during the year to clear up some production problems in the ginger crop. The reworking programme on one of the citrus blocks is virtually completed, and there is now a representative collection of plant types of potential value to the industry in Queensland. The Macadamia stock-scion orchard is coming into bearing, and data collected during the next few years should enable productive to be sorted out from non-productive types.

A new residence has been erected on the property by the Department of Public Works, and an access road has also been made to the site selected for the pineapple plant physiology laboratory and glasshouse. Construction of this laboratory is scheduled for 1960-61.

Redlands Experiment Station

In the programme of research at this Station priority is being given to nutritional and plant breeding problems in vegetables. Technical staff has been strengthened, and this should enable some outstanding investigations in soil management and water use to be undertaken.

Permanent office and laboratory accommodation is urgently needed. As a relief measure, an annexe is being built alongside the glasshouse for the use of officers who require both glasshouse and laboratory facilities. An evaporative cooling system has been installed in the glasshouse, in order to reduce its temperature during the hotter months.

Kamerunga

Facilities at the Kamerunga Experiment Station are limited, and its main function is to hold plant material of possible interest in the North. Cocoa is a recent addition to the series, and its introduction follows a survey of the potential for this crop in the wet tropical area. The Station supplies citronelle seed used by nurseries for the production of citrus trees, and a certified bean seed crop is also grown regularly each year.

HAMILTON FOOD PRESERVATION RESEARCH LABORATORY

The technical staff concerned with research on the storage, transport and preservation of fruit and vegetables took up duties at the Hamilton Research Laboratory on May 3, 1960.

The staff was strengthened by the appointment of five additional officers. This will enable an active programme of research on storage, transport, chemical, micro-biological and processing problems to be undertaken. One

FOOD PRESERVATION RESEARCH LABORATORY

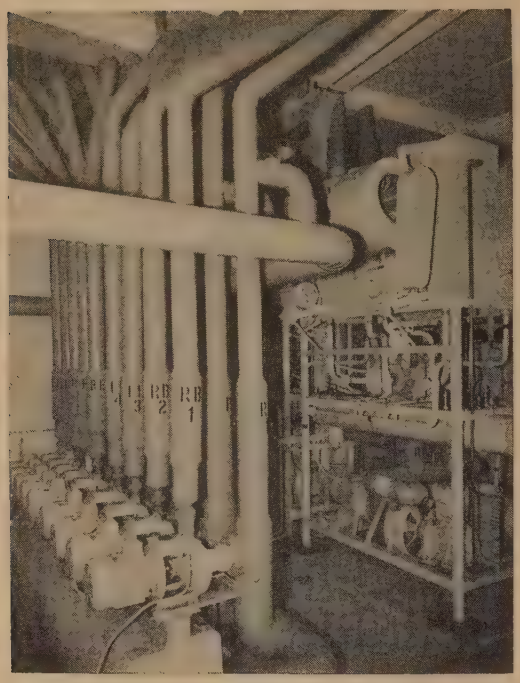


Plate 30.—Refrigeration for the cold rooms.

Plate 31.—Block of cold rooms for cool storage studies.

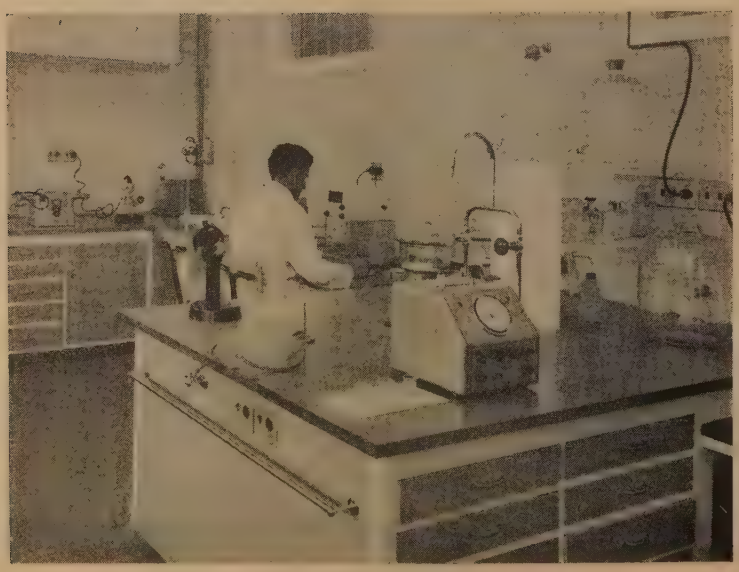


Plate 32.—A corner of the Processing Laboratory.

important function of the laboratory will be to investigate under accurately controlled conditions the storage life of our major horticultural crops and to develop improved methods of storage with a view to determining their interstate and overseas export potential. Another important phase will be research on crop utilisation, so that the best use can be made of our horticultural crops.

It is desired to acknowledge with gratitude the very generous financial assistance made by the Brisbane canners, the various Sectional Group Committees of the Committee of Direction of Fruit Marketing and the Queensland Can Company Ltd. towards the purchase of laboratory equipment.

SPECIAL SERVICES

The Citrus Budwood and Seed Distribution Scheme functioned smoothly during the year. Orders amounted to 120,000 buds and 221 lb. of seed. Some trouble was experienced in getting Joppa orange seed from the usual sources, but with the co-operation of growers all orders were finally met. Germination in sweet orange seed was marginal at the time of despatch, but strikes in the seedbed were generally satisfactory. Nevertheless, steps have been taken to overhaul extraction methods in this variety.

Nursery inspectional services indicate a marked improvement in managerial practices designed to ensure compliance with the provisions of the Diseases in Plants Acts, and a supply of good quality trees to the grower. High budding, which was enacted by legislation two years ago, has led to a marked improvement in the quality of the citrus trees placed on the market. This is indicated by the strong demand for Queensland grown trees from the southern States.

Bean seed production programmes in 1959-60 were on a reduced scale owing to the large Australian carryover stocks held from the previous season. Production amounted to 277 bus. of certified seed and 1,971 bus. of commercial seed from approved sources. The Burdekin Delta continues to be the safest production area in the State and is likely to become increasingly important.

Production of certified tomato seed is centred in the Stanthorpe district. In 1959-60 it amounted to 4,000 oz. of Q2 (carryover stocks), 1,200 oz. of Q3, and 400 oz. of Q5. Q2 remains the type in greatest demand, but the vegetable industry shows an increasing interest in both Q3 and Q5. The last of these was brought into the certification scheme three years ago and initally met a mixed response from the industry mainly because of its Rutgers parentage. Its fruit quality is, however, the best of the Queensland series.

The approved strawberry runner scheme has been in abeyance since 1957, when virus diseases contaminated stocks of planting material. The Plant Pathology Section in association with the Horticulture Branch has now built up nucleus stocks of disease-free parental material at the Maroochy Experiment Station, and it is hoped to resume commercial operations in 1961 with the variety Phenomenal.

REGULATORY

Inspections indicate that nurseries generally comply with the provisions of the Diseases in Plants Acts for both prescribed standards for fruit trees offered for sale and the effective control of pests and diseases. In view of the increasing importance of nematodes and the risk of introducing them to new orchards with young trees, a joint survey of nurseries by the Horticulture Branch and the Entomology Section is to be made.

Bunchy top control programmes in bananas were maintained during the year. The 1959 outbreak of the disease at Brooloo was effectively brought under control, and no recurrence has been recorded since in the district. A marked improvement in Southport and Beenleigh district plantations can be recorded, but control still presents a problem at Nambour, where large numbers of non-commercial and semi-commercial plantings exist. A minor outbreak at Wamuran required special attention because of its proximity to adjacent plantations. Bunchy top incidence during the year was generally low; infected plants represented only 0.04 per cent. of the total population.

EXTENSION

Extension officers had a difficult year. Returns to growers for some fruits were marginal and sometimes below costs of production. This created a demand for a re-appraisement of cropping programmes for greater diversity in production.

Extension services to migrants are complicated by language difficulties. The best results are being obtained by experimental and demonstrational plots on the properties of fellow nationals with a good command of English.

Six field days were held during the year, the most successful being on avocadoes and Macadamia nuts, both minor crops. This may be attributed partly to the current interest in alternative crops.

Group discussions continue to be a feature of the extension service. The more successful of these were associated with experimental or demonstrational projects where developments in research projects or production techniques could be visually appraised by growers themselves.

There was a heavy demand on the services of officers for technical advice and assistance on problems associated with the storage, transport and preservation of fruits and vegetables, and this demand is likely to be accentuated now that the Hamilton Research Laboratory is functioning. Regular meetings are proposed at this laboratory with the various Sectional Group Committees of the Committee of Direction of Fruit Marketing, the Brisbane canners and allied industries, the Queensland Food Technology Association and the Queensland Institute of Refrigeration.

School packing classes were conducted in conjunction with the Department of Education and about 680 students received individual instruction, compared with 360 in the previous year. The classes embraced about 36 schools in the Stanthorpe, Brisbane, South Coast, North Coast and Gympie districts. The completion of the course in each district is time to correspond with the local Agricultural Show, where selected students from individual schools compete for shields or trophies. The standard of packing shown by the school children was particularly high. In addition to conducting school classes, the three specialist officers are actively engaged in giving packing instruction to individual farmers.

EXPORT

There was a greater interest by growers and exporters in overseas shipments of apples, following a record crop which caused a recession in local prices. Exports to the United Kingdom covering the period February 20 to April 25, 1960, were an all-time record of about 105,000 cases of Granny Smith apples, for which satisfactory prices were obtained. There is a very good market in the United Kingdom for early shipments from Australia, and Stanthorpe has the geographical advantage of its fruit maturing before that of most other States. It is likely that exports in the future will continue to increase, and additional packing-house facilities have therefore been established in the Stanthorpe district.

An Export Advisory Committee comprising representatives of the Australian Apple and Pear Board, shippers, the Deciduous Sectional Group Committee and Departmental officers was set up to discuss export procedure and to advise growers on export requirements. The Department of Primary Industry financed a trip to Sydney, Melbourne and Hobart of the officer responsible for export inspection at Stanthorpe, to enable him to see at first hand export procedure in those capital cities.

The total exports from Queensland to overseas countries during the year under review were: apples, 127,869 cases; citrus, 10,468 cases; pears, 1,584 cases; pineapples, 817 cases; and vegetables, 11,200 packages.

A thorough inspection of all fruits and vegetables presented for export was made by Departmental officers, in order to ensure that the quality is of export standard.

QUARANTINE

During the year under review, additional staff was appointed to cope with larger imports of quarantinable material from overseas countries, particularly Japan and China. The main imports were:—bamboo, 2,273 bales; raw cotton, 776 bales; coffee, 4,687 bags; fibre, 6,758 bales; peanuts, 1,531 bags; plywood, 1,240 crates; logs 18,150; timber, 637,600 pieces; household pieces, 773 cases; plants, 54,931 packages; and merchandise, 32,298 packages; together with thousands of outside packages and timber crates. Close inspection of outside packages was necessary because of the possibility of European house borer being present in containers holding wine and spirits, olive oil and household furniture. All types of machinery coming into Queensland were thoroughly inspected and cleaned wherever necessary to remove adhering soil.

Introduction of nursery stock and other planting material was restricted to registered approved importers, while the number of plants which any approved importer can introduce was restricted to 10 of each variety. Inspection of overseas aircraft and migrant vessels resulted in the confiscation and destruction of much material which could be a means of introducing some foreign pest or disease into Australia. Co-operation with the Customs and Postal Departments has ensured that very few parcels reach the importer without prior inspection.

Plant quarantine publicity measures are proving effective, particularly in regard to tourists from New Guinea, and the number of prohibited articles seized by quarantine officers is now considerably fewer than previously.

A glasshouse is being erected in Brisbane by the Commonwealth Department of Health for the indexing and screening by the Plant Pathology Section of viruses in imported plant material of tropical origin.

REGIONAL EXPERIMENT STATIONS

Because of the diversity of the forms of agriculture caused by variations in climate, soil and water resources, research must proceed along different lines in different regions. There are, nevertheless, many phases of agricultural research that can be co-ordinated and knowledge obtained can be used in predicting performance in other localities.

The six Regional Experiment Stations are separated by large distances and each serves to handle specific problems of an important area of the State.

Much basic work is carried out, such as varietal testing in agricultural crops, comparison of cultural treatments, fertilizer trials, the testing of irrigation schedules and techniques and the testing of methods of pasture establishment and management. Problems of pest and disease control are investigated, and the use of chemicals in agriculture is studied. The facilities of the Stations are being used for horticultural investigations, plant breeding and pure seed multiplication to an increasing extent. Work related to the integration of crop and animal production for the purpose of evolving a balanced farming system embraces studies on dairy and beef cattle, sheep and fat lambs, pigs and poultry.

Rainfall data for all Stations are given in Table 1.

TABLE 1

REGIONAL EXPERIMENT STATIONS—RAINFALL, 1959–60 (INCHES)

	Ayr		Biloela		Gatton		Hermitage		Kairi		Millaroo	
	1959–60	Mean (14 years)	1959–60	Mean (37 years)	1959–50	Mean (College 61 years)	1959–60	Mean (14 years)	1959–60	Mean (8 years)	1959–60	Mean (3 years)
July	0·11	1·30	1·74	1·31	2·06	1·44	1·77	1·14	0·92	0·77	0·10	0·73
August	0·00	0·37	0·00	0·67	0·00	1·04	0·07	0·95	2·17	1·12	0·00	0·24
September	0·00	0·33	0·46	0·83	1·90	1·51	1·88	1·63	1·79	0·84	0·00	0·13
October	0·00	0·70	3·35	2·11	5·01	2·47	5·29	3·68	0·00	1·11	0·02	0·26
November	0·78	1·74	2·95	2·83	8·72	2·73	6·23	2·65	2·18	2·25	3·98	0·55
December	8·64	1·89	5·76	3·75	6·00	3·90	7·39	3·69	10·49	4·48	7·75	3·70
January	4·86	14·18	4·66	4·15	3·04	4·36	2·31	4·00	13·13	11·46	2·55	7·13
February	16·03	10·59	6·74	4·92	5·41	4·05	4·31	3·24	9·63	11·31	10·96	8·56
March	9·77	7·41	0·30	2·71	1·01	3·11	1·84	2·54	3·00	11·11	6·11	4·16
April	0·00	2·59	0·98	1·65	0·64	1·90	1·06	1·28	0·80	3·78	0·00	5·03
May	3·26	2·49	1·89	1·59	0·32	1·51	2·03	1·33	1·72	2·05	1·93	1·42
June	0·11	0·86	0·54	1·62	1·27	1·77	1·09	2·23	1·04	1·88	0·20	0·83
Annual Rainfall	43·56	44·45	29·37	28·14	35·38	29·79	35·27	28·36	46·87	52·16	33·60	32·74

HERMITAGE

Because of widespread denudation and siltation over the main experimental area of the Station following a flash flood early in 1959, land available for trial purposes was limited pending restoration of the area. This involved altering the location of various waterways and redesigning the layout of the experimental areas of black soil on the flat.

Winter cereals had a dry growing period followed by a wet harvest. Early summer rainfall was associated with cool temperatures which affected the germination of cotton. Late summer conditions were again dry and yields of such crops as soybeans and cotton were seriously reduced. Autumn rains were satisfactory and provided good soil moisture reserves for the winter crops.

Crops

Wheat.—Thirty acres were sown to wheat in 1959. Storm rains at harvesting caused severe lodging, and yields of the best varieties were reduced to an average 30 bus. per acre. In a comparatively rust-free year, Charter (30.0 bus.) and Celebration (32.1 bus.) yielded satisfactorily. Spica in the early-maturing trial (30.8 bus.) and the new release Hopps (32.9 bus.) in the late-maturing trial exceeded the others in their respective trials.

Protein content ranged between 12.4 and 13.7 per cent.

Oats.—An oats grazing trial was continued for the second year, and yields of up to 10 tons of green feed per acre, spread over four grazings, were obtained. Trials in which a legume (tares or field peas) was included with the oats are incomplete, but is was apparent that, under dry farming conditions, relative seeding rates need to be adjusted.

Sorghum.—High yields of grain sorghum were obtained, the mean yield from the main varietal trial being 107.9 bus. per acre. Hybrids bred on the Station significantly outyielded the standard varieties Alpha (81.4 bus.) and Early Kalo (73.9 bus.). In the case of Texas 620 an increase of 64 per cent. was made with a yield of 133.3 bus. per acre. Cytoplasmic male-sterile strains were again grown on the Station for plant breeding purposes.

Cotton.—Cold conditions experienced in October restricted germination and retarded early growth, so flowering did not commence until February. This did

not allow the crop to reach full maturity before the first frosts occurred and only token yields are expected. Work is continuing to ascertain the degree of risk entailed in producing economic yields of cotton, as an alternative cash crop to summer grains, in this district.

Other Crops.—Ten strains of soybean were grown with the commercial variety Nanda for comparison. A good stand was established and excellent early growth was made. However, as a result of dry conditions later, a negligible amount of seed was set.

Small areas of Jupiter sunflower and Brown Beauty French bean were grown for seed multiplication purposes.

Applications of nitrogen to rain-grown Russian comfrey are being investigated in relation to the effects on yield and protein content.

Rotations.—The 8-year cycle rotations, now in the sixth year, have commenced to show the beneficial effect of a rotation which includes four years under lucerne (Figure 1). However, first-year grain crops on a short fallow after the lucerne may suffer from lack of moisture. In all cases increased yields were obtained following lucerne. Mean yields (bus. per acre) were as under:—

	Wheat	Sorghum
Following lucerne	35.2	38.9
Control areas	31.8	32.9

Lucerne yields tended to decrease with age of stand, 11.12 tons per acre for 2nd year lucerne and 7.26 tons per acre for 4th year stands being obtained.

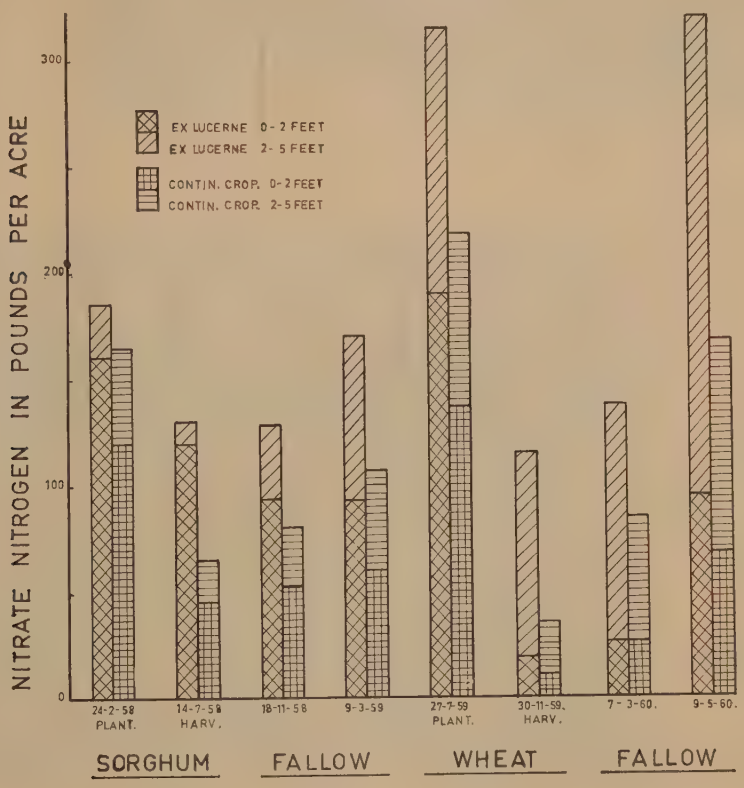


Fig. 1.—Available Nitrogen under Continuous Cropping and under Lucerne/Crop Rotation.

Pastures

The layout of the new nursery area was completed, and 64 species of legumes and grasses have so far been established in 143 rows.

An area totalling 76½ acres is now sown to improved pastures, while 133 acres of rather steep hillside are under native grasses and woodland. It is estimated that upwards of 200 sheep can be carried in the cooler months and 600 during the flush growth of summer. Various grass/legume mixtures are included, but lucerne continued to be the best legume component.

Results from the native pasture improvement trial were not well defined, as the excellent growing season masked the effect of possible fertilizer differences. Growth of the grasses surviving the renovation methods was more vigorous than elsewhere.

The response to application of superphosphate and sulphate of ammonia to sown pastures was marked, and whereas the control plots deteriorated over two years, both lucerne and Wimmera ryegrass responded well.

Livestock

New buildings in the Piggery Section, comprising feed store, office, farrowing pens and test-feeding pens, were constructed during the year, and it is now proposed to increase the breeding herd to 12 sows. Five progeny feeding trials were conducted, together with selective feeding and palatability trials on various feed mixtures. Mineral deficiency symptoms are also being investigated.

The grazing flock of sheep varied from 200 to 666 and included wethers and hoggets.

GATTON

Although investigations of irrigated pastures continued as the major phase of the experimental programme on this Station, work was expanded on important crops, especially lucerne and potatoes.

Growing conditions for pastures were much less favourable than in the previous year. The semi-drought conditions of the autumn of 1959 continued with little relief through the winter and early spring and were aggravated by the frequency of dry westerly winds. On the other hand, the spring and early summer months were excessively wet and much waterlogging occurred. Unusually dry weather again occurred in the autumn months of 1960.

Because of the long periods of dry weather, more water than usual was required to supplement the rainfall on the irrigated pastures, approximately 40 in. being used, compared with 35 in. in the previous year.

Irrigated Pastures

Standard Irrigated Pastures.—Some four years ago a series of recognised standard mixtures of pasture species was laid down to demonstrate the productivity and

PASTURE IMPROVEMENT TRIALS

Plate 33.—Research workers discussing the development of pastures on ridge country at Hermitage Regional Experiment Station, near Warwick.

Plate 34.—Improved pastures on the high ridge country at Hermitage Regional Experiment Station. The native pasture is chisel ploughed between contour banks.

Plate 35.—Studies of fat lamb production on irrigated pastures are conducted at Theodore Irrigation Research Station.

persistence of known compatible species under a normal grazing routine. The pasture cover and admixture of components have remained very even, and have given a high grazing efficiency at all times.

Phalaris arundinacea combined with white clover, and with either H1 ryegrass or perennial prairie, proved a particularly valuable summer pasture. It has the ability to provide an abundance of good grazing in January-April, when the commonly grown paspalum pastures are much reduced in value because of a profusion of seedheads and the presence of ergot. Average weekly green growth rates varied from less than 0.5 ton in the winter to over 1 ton in the summer, with total production of approximately 38 tons for the year (Figure 2).

H1 ryegrass continued to flourish in association with Louisiana white clover. A feature of this association in comparison with other mixed species is the high production in the autumn-winter period, which is normally a lean time for pastures. This mixture returned around 1 ton of green pasture per acre per week in the winter and approximately 38 tons for the year.

Irrigated summer pastures of paspalum, Rhodes grass and white clover continued to be productive in 12-year-old stands. Although almost the entire grazing was distributed over the months August-February, the total grazing for the year averaged 1.1 cows per acre.

Rain-grown pastures of Rhodes grass, green panic and lucerne supply feed during four or five summer months only. Green panic alone in rows averaged 0.17 cows per acre and with lucerne in rows 0.37 cows per acre. For Rhodes grass the figures were 0.33 and 0.47 respectively.

Winter Seasonal Pasture Trial.—A pasture species that could survive the summer without irrigation and be productive in the winter with supplemental irrigation would have advantages in the Lockyer Valley, where restrictions are sometimes placed on irrigation from streams in summer. The ability of Louisiana white clover to do this has been demonstrated over two seasons. Over a 12-month period and with no supplemental irrigation from October to March it yielded 38 tons of green material per acre, with good production in autumn, winter and spring. This contrasts with the

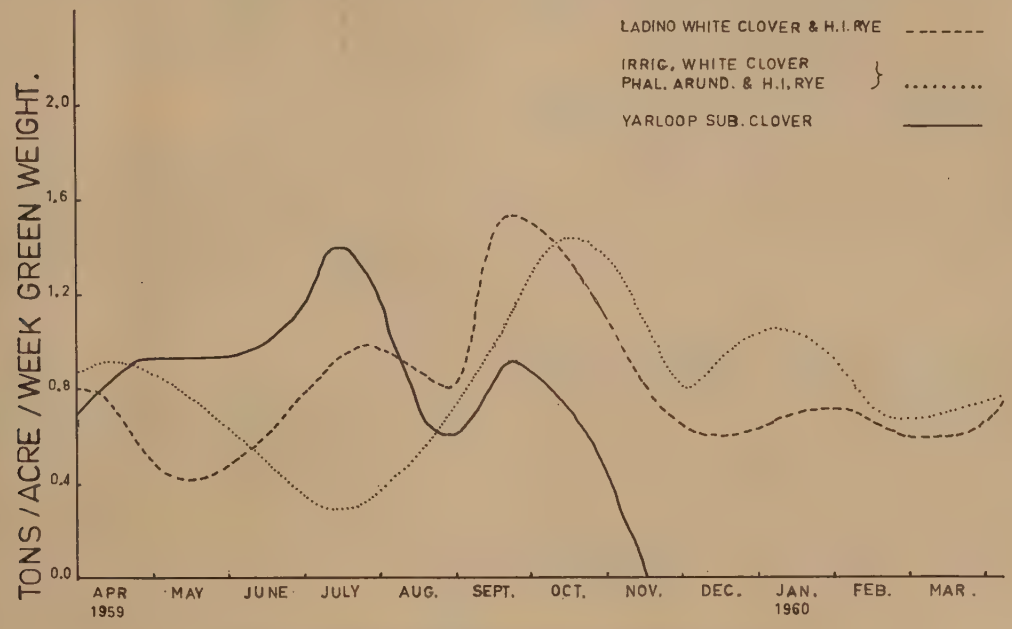


Fig. 2.—Production of Irrigated Pastures at Gatton, 1959-60.

Sod-seeding Trial.—H1 ryegrass was successfully sod-seeded into a stand of *Phalaris arundinacea* and Ladino white clover with the object of increasing the amount of winter grazing and reducing the risk of bloat at that time, when the clover tends to become dominant. The trial achieved its purpose of greatly increasing the winter production, which varied from approximately 0.75 to 1 ton per acre per week. For the whole year the mixture gave nearly 40 tons of green material per acre. This and previous work have indicated that sod-seeding can be a major means of pasture improvement at low cost. It is a particularly useful means of developing a balanced pasture in areas where clover has become dominant, which frequently happens during the process of improving the soil fertility of an area.

Simple Mixtures.—Irrigated pastures frequently comprise several species of grasses. Work at Gatton has shown that simple mixtures of one grass and one clover are equally as productive as the more complex mixtures of several grasses and clovers. H1 ryegrass, *Phalaris arundinacea,* Priebe's perennial prairie and cocksfoot have been the best grass species. Yields of green material of around 40 tons per acre per annum were obtained from these.

Other Pasture Trials.—A para grass and strawberry clover mixture continued to produce heavily on the poorly drained areas. An 8-acre area carried an average of approximately 1 cow and 1.5 sheep per acre for the year.

low production of summer-growing species in these seasons, and emphasises the usefulness of the self-regenerating legume.

Land Utilization Trial.—Annual winter-growing pastures are virtually unproductive in the summer. If advantage can be taken of the build-up of soil fertility by the pasture by growing a summer crop without detriment to the subsequent regeneration and growth of the winter pasture, much more profitable use could be made of the areas concerned.

Trials have shown that Yarloop subclover and maize is a combination that can be used for this purpose. After the clover has seeded in October-November, maize can be planted in December. The maize makes forward growth by the time the clover regenerates from seed in February. The clover subsequently makes growth in the standing maize crop and is ready for grazing in May. Sheep are used as they do not damage the maize grain maturing on the stalks. In 1959, maize yields from 4 ft. and 6 ft. rows were 151 and 117 bus. per acre respectively, and pasture yields 14 and 20 tons per acre respectively.

Crops

Potatoes.—Autumn potato crops planted in February 1959 were handicapped by impaired germination due to waterlogged conditions caused by heavy rainfalls after planting. The yields of 7.6 tons per acre for Sebago and 8.4 tons for Sequoia were most satisfactory

under the circumstances. Later planted crops (early March) fared better, and yields of 9.5, 8.5 and 7.7 tons per acre were obtained for Sequoia, Kennebec and Sebago respectively.

In the spring crops Sebago outyielded Pontiac in 36 in. rows, but the result was reversed when the varieties were planted in 30 in. rows. Close plant spacings of 12 and 14 in. gave higher yields than 24 and 28 in. spacings. Mean yield for the close spacings was 13.94 tons per acre.

The specific gravity of potatoes is a feature that can be used to gauge the quality of the tubers, and is especially useful to the trade interested in the manufacture of fancy products such as potato flakes, for which a quality standard based on a minimum specific gravity is required. As irrigation can affect the specific gravity, and hence the quality, of potatoes, a trial was conducted to determine the effect of different amounts and frequencies of irrigation on the specific gravity. Irrigations of 1, 2 and 3 in. were each applied at periods of 7, 14 and 21 days. Heavy rain late in the season evened out the effects of the different irrigations and vitiated the comparisons. All tubers had a very low specific gravity of 1.052, which reflected their poor quality. A reasonable quality standard appears to be a minimum specific gravity of 1.080.

Lucerne.—Trials over three years have given strong indications that lucerne stands are much improved in growth and leafiness by fertilizers containing sulphates. To investigate this matter further a trial was set out to determine the quantity, form and frequency of application of sulphur required for maximum production.

Cotton.—Good growth was made in a seed increase plot of Acala 1517 BR, with fruiting very good in most of the area. Frosts in late May did not harm the mature crop and a good yield of seed cotton is expected.

Maize.—Trials with two Queensland hybrids, Q.692 and Q.739, proved the superiority of the latter in ability to withstand storms. Q.692, which is rather thin-stemmed, lodged badly after a hail-storm and cyclonic winds. Final yield results are not yet available.

Miscellaneous.—A stock-scion lemon trial was established, together with an observation trial of six sources of lemon scions on trifoliata stock (N.S.W. strain).

Land and assistance were made available to other Branches of the Department for experimentation purposes and work done in this way included fruit fly observations, wheat and oat nursery trials, and an onion weedicide trial.

Stock

Fat lamb production from the Border Leicester/Merino ewes and Dorset Horn and Southdown rams was again satisfactory. The percentage of lambs delivered for slaughter for ewes mated was 139. Lambs at 63-65 days old averaged 33 lb. cold weight.

BILOELA

This station of 430 acres is on Callide Creek near Biloela. It was first established in 1924 as a cotton research station. In its present form as a Regional Experiment Station, a wide range of activities is undertaken. Investigations are related to summer and winter agricultural crops and pastures and to dairying and pig raising. Availability of irrigation water adds stability to the programme and increases the range of experiments which can be undertaken.

The past year was characterised by lower-than-average winter and autumn rains, while spring and summer rains were above average. The total rainfall of 29.4 in. approximated the mean for the 37 years for which data are available. Of great benefit and importance was the May 1960 total of 1.89 in. which ensured timely sowing of winter crops on well-fallowed land.

In the agricultural programme emphasis was again placed on cotton, but serious disease and insect losses depressed yields in a number of trials. Kenora wheat, which was bred by Departmental plant breeders at Hermitage Regional Experiment Station, showed promise, while a new hybrid sorghum strain outyielded the standard varieties by 65 per cent.

Encouraging results were obtained in the field of pasture research, the outstanding production of Priebe's perennial prairie being worthy of special note. Growth rate studies in irrigated pastures helped solve important management problems, while nitrogen fertilizing of elephant grass led to some interesting conclusions about this species.

In the animal field, a general increase in production has followed the improvement of the plane of nutrition for dairy stock. Tallow spraying of irrigated pastures to prevent bloat was very effective and allowed introduction of 24-hours-a-day grazing of grass/clover pastures. The piggery continued to function well and the good results obtained are largely due to the very sound, even type of Large White breeding sows in use. A suspected vitamin A deficiency was noted in pigs deprived of green forage.

Summer Crops

Cotton.—Rain-grown crops were planted in early October, approximately one week earlier than usual, and had excellent growing conditions until mid-February. Irrigated cotton was planted in mid-October and because of good summer rains less irrigation was required than in a normal season. Mean yields were less than half the average of all years. Irrigated crops averaged only 500 lb. seed cotton per acre, while rain-grown crops averaged only 300 lb.

The factors which helped to reduce yields drastically were mainly insect pests and diseases. Pink bollworm was severe for most of the fruiting period and caused heavy losses. Heliothis and loopers were active in mid-season and caused some damage. Angular leaf spot (*Xanthomonas malvacearum*) caused severe damage to leaves and stems. Humid weather caused rotting of opening bolls in lush irrigated cotton. In addition to these maladies a disorder known locally as "bad boll opening" caused serious losses. Investigations are being made into the cause of this disorder.

The trials which gave the most useful information were those involving insecticidal applications, and yields were much higher from these than from other experiments. In two trials involving 0.1 per cent. DDT spray and 10 per cent. "Sevin" dust, good yield increases were obtained over controls. Eight sprayings were made at weekly intervals. Yields of seed cotton per acre are set out below.

Treatment	Irrigated	Rain-grown
DDT	966	414
"Sevin"	701	327
Untreated	352	196
Means	673	312

In the varietal trials yields were too poor to draw any sound conclusions as to the performance of the several varieties.

Experiments involving skip-row and ripping techniques were completed, the final results indicating loss of yield from skip-row procedure and no benefits resulting from ripping.

Defoliants A6284 and X5 gave encouraging results. The pre-emergence wedicides C.I.P.C. and C.D.A.A. offer the best results so far for the control of black pigweed and barnyard millet.

Sorghum.—Heat sterilization caused a reduction in sorghum yields but no midge damage was reported in the current crop. Mean yield for the variety trial was 28.6 bus. per acre, with the best performance from Martin (36 bus.). In a hybrid strain trial, Texas 610 (60.5 bus.) outyielded the standard variety Alpha (36 bus.) by 65 per cent. A number of other hybrids performed well.

Silage.—During the summer of 1959-60, 250 tons of a mixture of velvet bean and sweet sorghum was forage-harvested from an area of 20 acres and ensiled. The silage is used extensively in feeding dairy stock on the Station.

Sundry Summer Crops.—Seed increases were made of Polestar sunflower and of Blackeye 5, Santiago and Havana cowpeas. A seed increase area of guar bean is expected to yield well.

Winter Crops

Wheat.—Rust infection was negligible in 1959, in sharp contrast to the experience of the previous year. Saga (34 bus.) and Gabo (32 bus.) topped the variety trial. Kenora (32 bus.) and Spica (31 bus.) performed well. Kenora is expected to become very popular in the district.

In a trial of slow-maturing varieties, the unsuitability of such varieties for conditions at Biloela was shown in the following comparisons:—Spica (quick-maturing), 25 bus.; LxG 5391 (slow-maturing), 15.6 bus.; and Hopps (slow-maturing), 8.9 bus. per acre.

Other trials demonstrated the benefit of early planting and of bare fallowing between wheat crops in preference to growing cowpeas for green manure or for seed during the summer.

Oats.—Good seed increases were obtained from Seminole, Florilands, Saia and Landhafer varieties.

Crops were grown for dairy grazing, and one area was set aside for a comparative grazing trial of oats and safflower. Stock appreciated the safflower grazing and, as can be seen from the yield data (in tons per acre), production from this crop compared favourably with oats:

	Green Material	Dry Material
Safflower	6.9	1.1
Oats	3.8	0.8

Safflower.—As well as the grazing trial, a row-spacing and rate-of-sowing trial was carried out. For grain production at Biloela it appears that best results can be expected from planting safflower in 14 in. rows at 27 lb. per acre or in 21 in. rows at 18 lb. per acre. Yields from these plantings were 1,764 and 1,840 lb. per acre respectively.

Pastures

Lucerne.—This crop was treated as a pasture where grown under irrigation and was cut for hay only when surplus to grazing needs. Good production was achieved in this way. Rain-grown lucerne did not produce well.

Nursery Investigations.—A number of new introduction were established.

Promising results were obtained with material selected from ryegrass and Elephant grass plots.

Treatment of the sterile interspecific *Phalaris* hybrid, Ronpha grass, with colchicine resulted in the production of some fertile seed. Seedlings were produced to plant out plots for further study of this promising species.

Irrigated Pastures.—Detailed work showed that under Central Queensland conditions year-round grazing can be provided by the combined use of two mixtures each with two components. Ladino clover/*Phalaris arundinacea* will maintain good production from spring to late autumn, while Ladino clover/perennial prairie grass is at its best from autumn to spring.

Growth rate studies of these two pasture mixtures provided useful basic information, from which it may be concluded that Ladino clover will perform well within the range of temperatures experienced at Biloela, and that at its periods of strong growth maximum production of clover is obtained between the 4th and the 5th week following grazing. Grazing at intervals of less than four weeks would handicap the grass component, which reaches its maximum production later than clover. Intervals between grazings would have to be lengthened for the different mixtures during periods of reduced growth.

Work continued in an attempt to find winter-growing pasture species which will regenerate in autumn without irrigation during the summer. Priebe's perennial prairie grass and Wimmera ryegrass have shown most promise under these conditions.

Irrigated elephant grass was studied in a fertilizer trial in which up to 200 lb. of nitrogen per acre was applied, after cutting, every six weeks during the period September 1959—May 1960. Yield figures indicated that maximum response to the nitrogenous fertilizer occurred during the period of high average temperature. Moisture conditions were good throughout and it therefore appears that, for this species, temperature is the limiting factor to production during early spring and autumn. Most efficient use of nitrogen was made by applications equivalent to 50 lb. of nitrogen. In this treatment, yields over the nine months were double those of the unfertilized grass (38 and 17 tons of green material per acre respectively).

Stock

The dairy herd grazing rain-grown pastures was fed a grain ration of 6 lb. per day for one month prior to, and two months following, calving. Butterfat production increased as a result of the feeding and it was shown that while the price of sorghum was low (£15 per ton), feeding of grain was an economic proposition.

The herd on irrigated pastures was given full-time grazing on tallow-sprayed clover/grass pasture. Yearly production was increased from 200 to 265 lb. of butterfat per cow as a result of the more adequate nutrition provided by the longer grazing period.

Twelve Large White breeding sows and their piglets are maintained at the piggery, total numbers at any one time ranging from 100 to 125 pigs.

Symptoms of vitamin A deficiency were noted in sows and piglets where sows were denied green feed.

Numerous feeding trials with pigs are being undertaken using a series of protein supplements. Hogging-down trials with grain sorghum, sweet sorghum and maize were conducted. Greater use was made of grain than of stalk and it was shown that this practice may have commercial possibilities when operated on a large scale.

Further information on activities in the dairy and piggery sections can be found in the respective Branch reports.

THEODORE

In addition to the demonstrations of irrigation methods and pasture establishment, two main lines of investigation were followed. These are (1) development of irrigated pastures which will give year-round production for sheep grazing, and (2) evaluation of methods of sheep husbandry and fat lamb production. Weather conditions were similar to those encountered at Biloela, except that at Theodore summer rains were lighter and autumn rains were heavier.

Pastures

Pastures generally produced well and a very high carrying capacity (over 10 sheep per acre) was achieved. As experienced elsewhere, complex mixtures have reverted to simple mixtures of two or three species. In the light of present knowledge the following mixtures planted in separate paddocks and grazed according to seasonal production are considered suitable for providing a heavy carrying capacity throughout the year:—(1) Ladino clover and Priebe's perennial prairie grass (winter-spring-summer). (2) Ladino clover or white clover and paspalum (spring-summer-early autumn). (3) Ladino clover and *Phalaris arundinacea* (spring-summer). (4) Lucerne alone for hay or grazing as required (all the year).

The white clover and paspalum pasture has special merit. It withstands sustained stocking and irregular management and affords firm standing for livestock during protracted wet periods and after irrigation. Production from Priebe's perennial prairie grass was outstanding, while Ladino clover was generally superior to white clover. Oats was successfully sod-seeded into summer-producing pastures to afford additional forage during the winter.

Sheep

The remainder of the Corriedale ewes purchased in 1956 were sold during the year and 180 Border Leicester X Merino first-cross ewes (in lamb to Dorset Horns) were purchased. With the 200 Merino ewes, this brings the main breeding flock up to 380 head.

Lambing percentages in 1959 were poor (Merino 70 per cent., Corriedale 83 per cent.). Young rams and the new group of young ewes should help to increase percentages in the near future. As was expected, lambs from Merino ewes matured slowly. An assessment was made of the comparative value of the two types of lamb produced, viz. *ex* Merino and *ex* Corriedale. The two

main compensating factors were value of wool produced by the ewe and carcase value of the lamb. The annual return was approximately £4 per ewe in each case so there was little difference between the two breeds. Merinos cut 8 lb. 9 oz. per fleece and averaged 71d. per lb., while Corriedales cut 7 lb. 11 oz. per fleece and averaged 55d. per lb. For the coming season a comparison will be made between crossbred and Merino ewes in fat lamb production.

Cotton

High nitrate-nitrogen at planting made use of nitrogenous fertilizer unnecessary. Bad boll opening as in the previous season will reduce yields considerably.

Exploratory Plots—Gibbergunyah

This was the third year of study of methods of developing melon-hole country for irrigation at the recently opened settlement of Gibbergunyah. The effect of complete levelling over one, two and three years has been observed, and in May 1960 the first permanent irrigated pastures were planted. This Department has been advising on cultural and cropping programmes while the Irrigation and Water Supply Commission has implemented the programmes.

From the information so far obtained it appears that:

(1) Satisfactory annual cash crops can be grown in the year following quick levelling for irrigation with heavy machinery. Hence progressive levelling, which delays use of land for irrigation, is not warranted. Unevenness in crop growth was less than anticipated in both years.

(2) Cotton and grain sorghum are suitable crops for this initial phase.

(3) The variable soil pattern and the differences of soil fertility appear to be of less importance in determining whether permanent irrigated pastures be sown after grading operations than is the possibility of soil subsidence, which can create irrigation difficulties. Levels will be checked periodically to test whether quick (1-year) or protracted (3-year) levelling has any effect on such subsidence.

AYR

Very dry conditions prevailed in the winter months and continued until December. Prolonged cold weather with frost in July caused damage to all crops and pastures. No extensive rainfall occurred during the period January to March, while the low average humidity, high temperatures and two hours more sunshine per day than the average for this period combined to create an unusual "wet" season. Dry weather continued throughout the autumn and early winter.

Crops

With the impending transfer of responsibility for this station to the Cattle Husbandry Branch, trials with agricultural crops were aimed at finalising the experimental programme already commenced.

Cotton.—The results of cotton trials at the station over the past 10 years have indicated great variation in yields. Early in the season rough bollworm is the major pest species. It causes severe terminal damage which affects maturity. Other bollworms cause a smaller, but continuous, loss of fruit.

In an insecticidal trial conducted in 1959 large yield differences resulted between plots sprayed nine times with a combination spray (1,650 lb. seed cotton per acre) and the unsprayed plots (450 lb. seed cotton per acre).

Winter temperatures are usually low enough to appreciably check plant growth. As a consequence, emphasis is placed on quick-maturing strains that will set a bottom crop before the onset of the cold weather and on early seedbed preparation. The latter must necessarily be done during the wet season, as opportunity permits, in order to destroy grass growth. Early preparation enables early planting to take advantage of available soil mosture. Early planting provides a longer warm period before the cool winter months, which favours seedling growth.

Applications of nitrogenous fertilizer to accelerate plant development after the leaching effect of the rains have not been economically successful. Although increased yields have been obtained they still remain at a relatively unattractive level. However, this has been primarily due in recent years to the prevalence of boll rots.

Seedbed conditions in this area usually leave much to be desired owing to the difficulty of soil preparation during, or immediately following, rains. It has been found that the performance of cotton planted on such a hurriedly prepared seedbed largely depends on the amount and nature of the plant material ploughed into the soil. Large amounts of grasses are usually incorporated in the seedbed and a trial completed this year emphasised the bad effect of this practice on the cotton crops that immediately follow it. In a year when yields were generally poor, cotton following grass harvested 360 lb. per acre, compared with a yield of 460 lb. per acre for cotton grown on a bare fallow, and 680 lb. per acre after cowpea.

The best time to plant after ploughing in a legume was investigated and it was shown that excessively vegetative plants developed if sowing was delayed a month. This was apparently due to the high nitrate level (38 p.p.m. of nitrogen) which built up in the soil. The resultant crop yielded only 242 lb. of seed cotton per acre. On the other hand, cotton planted directly after the turn-under benefited by a gradual nitrate release (maximum level 7 p.p.m. of nitrogen) and yielded 703 lb. per acre.

Legume Seed Production.—The frost experienced in July caused serious damage to centro and reduced yields. Glycine was also affected, but a second crop of seed yielded 140 lb. per acre. By comparison, stylo was not affected at all, and yields of 118 lb. of seed per acre from a 9-months-old stand, and 180 lb. per acre from an older crop, were obtained. Some demonstrations of harvesting techniques were given to farmers interested in this potential new industry. As the climate of the Lower Burdekin Valley is favourable for development of a legume seed industry, and because of a demand for cowpea seed by cane-growers, considerable time was devoted to the investigation of means of mechanically harvesting this crop. It was found that the mowing and harvesting technique used for glycine and centro could be adapted to the harvesting of the newer varieties of cowpea. However, threshing efficiency still leaves much to be desired.

With a view to facilitating the harvest of the crop directly and avoiding the mowing operation, trials of a number of chemical defoliants were conducted. PCP fortified with 30B oil in 50-100 gal. of water was found to be effective. The cost of the chemicals was only a small fraction of the value of the seed obtained.

Applications of hormones to induce seed setting of cowpeas proved abortive owing to the early maturation of the plants due to the abnormally dry summer weather.

Of the three varieties under observation, Malabar performed best under the dry conditions. Santiago and Blackeye 5 favour wetter conditions and are wholly resistant to infection by stem rot.

Nut-grass Investigations.—Following promising results obtained last season, further trials were conducted using various dry weather treatments combined with 2,4-D spraying during the summer. Dry cultivation alone reduced the number of nuts to the point where normal agricultural cropping would be possible for at least one season. However, to prevent rapid multiplication of nuts during the rains, a dense cover crop or regular discing would be required. The mean original density of 78.75 nuts per cu. ft. of soil was reduced by dry cultivation treatment to 9.33 nuts. Spraying with 2,4-D amino salt during the summer further reduced this number to 1.17 nuts per cu. ft. After such treatment a continuation of regular spot sprayings might eradicate this pest in small areas.

Pastures and Stock

Pasture growth followed the usual seasonal pattern, but for the first time on record serious frost damage occurred and it became necessary to provide supplementary feed. Three acres of sorghum and cowpeas supplied 70 tons of green fodder over a period of 10 weeks.

In preparation for the commencement of the tropical dairy cattle cross-breeding trials, the fencing and water facilities were reorganised. A Sahiwal-cross bull was used on the Station in the initial mating programme.

Horticulture

Work with pineapples was confined to fruit induction and controlled cropping in order to produce the best fruit at the most opportune time of the year. The rough-leaf varietal trial was also continued and in the ratoon crop Alexandra variety produced the largest fruit and confirmed the results obtained from the plant crop.

Areas of bananas held to provide planting material maintained satisfactory growth.

Testing of various southern varieties of papaws and work on the purification of a local strain continued.

The evaluation of a suitably coloured, self-pollinating variety of passionfruit, showing resistance to various diseases, was studied, using selections from hybrids obtained by crossing *Passiflora edulis* with *P. edulis* f. *flavicarpa*. Promising results were achieved.

A seed increase of the French bean variety 121-2 yielded 18 bus. of certified seed. In a varietal trial of canning peas to test seed production in this district for supplying the southern canning market, yields up to 8,000 lb. per acre were obtained. A trial of culinary beans using Queensland-grown seed had to be planted later than desirable owing to proximity to certified beans. The climbing varieties yielded better than the dwarf types, but results were not conclusive.

MILLAROO

Conditions were very dry from April to November, but during the succeeding five months a total of 31 in. of rain was received from local storms. Apart from some cold weather in the winter of 1959, temperatures during the year permitted normal growth.

Crops

Tobacco.—The mean yield of saleable leaf from all trials was 928 lb. per acre, returning approximately £520 per acre. While conditions generally were favourable, growth was inclined to be rank on well-prepared land, nitrogen exerting a very strong influence on plant development. Blue mould again caused extensive damage to the lower leaves, while the late-maturing plants were severely attacked by leaf miner.

Rainfall during early summer was sufficiently heavy to mask any differential effects of treatments in the irrigation trial. Differences in the chloride content of the soil were not significant and leaf analyses are expected to reveal low chloride content.

Early ploughing-in of Rhodes grass prior to planting caused better early growth of tobacco. Despite fertilizer application, later ploughing-in exerted a deleterious effect by increasing nematode infestation, and reduced the yield of saleable leaf.

Applications of nitrogen to plants fertilized basically with phosphorus delayed maturity and increased the amount of trashy leaf. Applications of potassium exerted no significant effect.

In the soil fumigation trial much reduced nematode populations occurred in all plots treated with EDB. However, yields of saleable leaf were not significantly increased thereby.

The rotation trial was continued into the third year. Plants following crops of sorghum, Rhodes grass, and Rhodes grass with centro, were slightly greener than desirable, while plants in the third year continuous tobacco areas were smaller than those in other treatments. The values of leaf were increased by an average of £71 per acre following grass as compared with the third-year crop. There was no difference in yield between Hamilton Hicks and Mammoth Delcrest varieties.

A small plot grown on Glenalder soil type yielded at the rate of 1,280 lb. of saleable leaf per acre.

Cotton.—Insects, especially rough bollworm, were the main reason for the very poor yields obtained, although a particularly cold morning in late July very severely affected plant growth and subsequent development. From the six trials conducted, in which the D & PL variety was used, a mean yield of only 357 lb. of seed cotton per acre was obtained. However, yields of up to 630 lb. per acre were obtained from a December planting and up to 900 lb. per acre in a fertilizer trial. In the entomological trial, sprayed plots yielded a mean of 444 lb. per acre, compared with only 24 lb. per acre from the unsprayed areas.

Maize.—Results were in keeping with previous trials which indicated that on the better soils a deficiency of nitrogen is the main factor reducing yields of grain.

Applications of 50 lb. and 100 lb. of nitrogen per acre raised the yield from 72 to 101 bus. per acre. The yield of 72 bus. without fertilizer, compared with the district average of about 50 bus., indicates the importance of a short summer fallow and close plant spacing.

In the varietal trial, Victory produced 85 bus. per acre and significantly outyielded other hybrids.

Other Crops.—An area of French bean mother seed yielded 23 bus. of certified seed, and a significant increase was obtained by the application of sulphate of ammonia at 2 cwt. per acre as a side-dressing.

Trials with soybeans, castor beans, clovers and temperate grass species were conducted. Several species of subtropical grasses and legumes were studied in a nursery and areas of the tropical legumes centro, glycine and stylo were again grown for seed production purposes.

Trials on Flood Plain Soils

Cotton yields on the heavier soils of the Oaky series (average 485 lb. per acre) were as good as on the lighter soils and were not significantly increased by the application of fertilizer. Insect damage appeared to be less severe.

Because of damage by birds, yields of maize were low, but the importance of the addition of phosphate to these soils was quite apparent.

The yield of oats was increased from 0.71 tons to 3.37 tons dry matter per acre, and grain yields from the same crop rose from 7 to 30 bus. per acre with the use of a complete fertilizer mixture. The principal response was due to very heavy applications of superphosphate.

On the Barratta soil type the growth of para grass was trebled by the addition of 10 cwt. of sulphate of ammonia per acre (2.5 to 7.6 tons of green material per acre).

In an endeavour to improve the physical condition of these heavy soils, ploughing to different depths was resorted to, while gypsum was applied at various rates. Slight increases were obtained with heavy applications of gypsum combined with deep ploughing.

An investigation of the long-term effect of various grasses in improving these soils was commenced in 1959. Growth of Rhodes grass has been very favourable, while elephant grass and sugar-cane seem to offer good prospects.

KAIRI

Investigations at this Station are directed to problems of the primary industries on the Atherton Tableland in North Queensland. The elevated plateau, varying from 2,000 to 2,400 ft. above sea level, receives an annual rainfall of over 50 in., and although located just south of 17 deg. S. latitude its climate ranges from temperate to subtropical. The northern section of the Tableland is mainly devoted to maize and peanut production, while dairying is the main industry in the wetter and rougher southern section.

On the experiment station the main research involves agricultural and grazing crops, pastures, dairying, and pig and poultry raising.

Soil deterioration and a decline in fertility under continuous cropping have resulted in lower maize yields over the Tableland generally, and although much work is in progress to develop new and hybrid varieties and to obtain greater yields by the use of fertilizers and better disease and weed control, the long-term investigations on the Station aim at restoration of soil fertility by rotational farming and use of pastures and grazing

animals. In these investigations, which require highly productive pastures, notable success has been achieved by the use of a tropical legume, *Glycine javanica*, originally introduced from Kenya.

Improvement of organic matter and soil nitrogen are essential steps in the restoration of soil productivity, and to date the use of the legume has been very successful in this respect. Similar results can be obtained from more costly nitrogenous fertilizers but no lasting beneficial effects result from this practice.

Outstanding increases have been achieved in crop production by application of nitrogenous fertilizers, but the use of a soil restorative phase of grass and legume pasture through grazing animals may have economic advantages while giving more permanent soil improvement. Nevertheless, the use of nitrogen on pastures may hasten these soil improvement processes and this aspect is being investigated.

Seasonal conditions were satisfactory and above-average rains in the winter and spring months maintained feed supplies and facilitated early land preparation for crops.

Crops

Maize, 1958-59.—Plantings in December and early January experienced very favourable conditions which resulted in excellent growth and cob development. In the later part of the season humid conditions assisted weed growth, and although a severe attack of leaf rust occurred in late March the advanced crops were not adversely affected.

Ten hybrid and one Dent strain of maize were included in variety testing. Top yields were recorded from Grafton hybrids GH128, GH327 and GH170, which averaged 73.2 bus. per acre. Open-pollinated Dent yielded 62.4 bus., which was significantly higher than the other seven hybrids.

From fertilizer and spacing trials conducted over the past five years it was concluded that close spacing of plants (11 in.) gave highly significant increases over wide (18 in.) spacings. The addition of 80 lb. of nitrogen as a side-dressing of sulphate of ammonia resulted in an insignificant and uneconomical increase in yield.

In interaction studies the increase in yield by close spacing was enlarged by the application of nitrogen but the difference was not significant. Although there was no direct evidence, indications were that the variety Durum is not a potentially high yielder and that more satisfactory results can be expected from hybrid material.

Applications of urea foliar sprays to supply 10 and 20 lb. of nitrogen per acre resulted in small yield increases but only the higher rate was significantly better. Yields were:—control 43.6 bus.; 10 lb. nitrogen 46.8 bus.; 20 lb. nitrogen in a single application 50.9 bus.; and 20 lb. nitrogen in two applications 51.0 bus. per acre.

No significant differences were obtained in yields from the annual trial of local Durum and Dent strains, and crops produced from 48.6 up to 56.7 bus. per acre.

Fourteen single-cross strains were tested to determine the value of material which will be utilised later in plant breeding projects.

Spacing trials were conducted with open-pollinated and hybrid varieties. Hybrid types were again superior and it was also shown that under favourable seasonal conditions close spacings of 10 in. between plants yielded 75.5 bus. per acre whereas only 60 bus. per acre were obtained at 15 in. spacings.

Bulk areas were sown to Durum and GH128 hybrid, the latter averaging 46.5 bus. per acre, which was an increase of 70 per cent. over the open-pollinated Durum maize.

Maize, 1959-60.—The whole of the bulk areas and most of the experimental plantings were sown to hybrid varieties in December and early January. Growing conditions were good. There was less leaching rain than usual and the wet season terminated abruptly at the end of February. Harvesting has commenced in one bulk area and a yield of 75-80 bus. per acre is anticipated. Maize grown for silage produced 15 tons of green material per acre.

Winter Crops.—Trials with oat, barley and wheat varieties were conducted. Oats can be of great value when pastures are non-productive during autumn and winter, although susceptibility to rust can severely reduce production of some varieties in wet winters. Highest production was obtained from the varieties Benton, Vicland, BVH 4982 and Orient, but the last was severely affected by rust.

Miscellaneous Crops.—Mung bean continued to perform well as a green manure and as a grazing crop. Studies of several new varieties of fodder cane have not produced any evidence that Co. 301 can be superseded at this stage. Areas of fodder cane and elephant grass are maintained to supply sets to farmers in the districts. Over 200 farmers have been supplied with seed of *Glycine javanica* to enable wide testing of this legume on several soil types and to encourage seed production.

Pastures.—Useful rains in August and September assisted early spring growth and later storms assured lush summer growth. The first half of 1960 had below-average rainfall and pastures and oats sown for grazing progressed slowly.

In a demonstration rotation embracing pastures, maize for grain and grazing crops, modifications were effected to replace lucerne with glycine in the mixed pastures. The latter legume has given sufficient promise to anticipate an increase in dairy production by its inclusion in the pasture; and by virtue of better pasture growth an improvement in soil fertility may be effected in a reasonable period. It has been shown that pastures of green panic or Rhodes grass combined with lucerne will deteriorate in productivity after three or four years, but pastures of these grasses with glycine tend to improve with time. Therefore, it may be necessary to recast the rotational schedules for cropping to obtain full value of the pasture phase while also lowering costs of cultural operations.

A new plant introduction nursery was established; some 50 tropical and temperate legume species and strains are included in it.

Pasture establishment trials with glycine and lucerne mixtures showed that better growth follows wet-season plantings. However, there were germination problems and weed competition was severe. The results also showed that lucerne does best after May plantings.

Nitrogen deficiency is the main factor limiting pasture growth, especially on some older pastures, and studies were continued on fertilizing practices aimed at overcoming the deficiency. Significant yield and protein increases followed the fertilizing of Rhodes grass with 4 cwt. of sulphate of ammonia and these effects were maintained until the fourth cut after application. A second application in late summer also showed significant response to nitrogen for three cuts. Lucerne responded to phosphate and dolomite applications but not to nitrogen.

In a fertilizer trial on a 5-year-old stand of green panic grass and glycine, high increases in grass production were obtained, but glycine regrowth was checked on areas receiving applications of approximately 300 lb. of sulphate of ammonia per acre in early summer.

Pot trials were commenced to study the production of nitrogen by rhizobia on the legume glycine and to ascertain the effect, if any, on the associated grass.

Stock

Dairy.—The average production of the Jersey herd utilised on the demonstration area involving rotation of pasture and maize-growing was 250 lb. butterfat per cow in the last completed recording year. This is equivalent to 91 lb. of commercial butter per acre, which is an increase over the previous year's production of 86 lb. commercial butter per acre (240 lb. butterfat per cow).

The production of the experimental herd of A.I.S. cattle was 148 lb. butterfat per cow. Trials with this herd included studies of heat tolerance and lifetime concentrate feeding. Portion of the herd was mated to a Sahiwal bull to obtain progeny for use in tropical dairy breed development at Ayr. Similar cross-breeding with Friesian cows is also planned.

Six bulls (3 A.I.S. and 3 Jersey) were worked at the Artificial Breeding Centre. Over 6,000 cows, or one-sixth of all dairy stock on the Tableland, were inseminated by the Co-operative Association during the year.

Pig-raising.—The main programme relates to sow nutrition studies wherein up to 12 sows are fed a maize/protein ration according to liveweight. From these studies, which are in progress at several centres, it will be possible to provide details for sow and litter feeding on Queensland foodstuffs based on actual measured performance.

In maize hogging-down trials, quality of marketed baconers was more closely related to parentage than to the type of grazing provided. However, pigs which hogged-down maize and pasture were superior in grade to those fed maize liberally in pens.

An outbreak of leptospirosis resulted in some losses of young pigs. Of the total sales of 138 porkers and baconers and three sows, 109 were classified as first grade.

Poultry.—A lighting trial is in progress to determine whether the installation of artificial lighting would prove economical under local conditions.

No differences were observed in current nutrition studies comparing rations of whole sorghum or maize plus meatmeal with mash feeding of the same constituents.

Diseases were prevalent during the year and outbreaks of intestinal coccidiosis, blue comb and blackhead occurred.

Details of the various animal husbandry investigations are reported by the respective Branches.

WALKAMIN

A unit of 640 acres at Walkamin, in the Mareeba-Dimbulah Irrigation Project, was acquired in 1959 and an experiment station was established on it under a joint agreement between the Department and the Irrigation and Water Supply Commission.

This centre will undertake investigations relative to land and water use on the various soil types present in the south-eastern section of the new developmental area. There are at present approximately 60 acres of cleared land, mainly on volcanic soils of the Mapee clay loam series, which will be utilised for agricultural crops and pastures. On the more extensive and less fertile soils a programme of irrigated pasture research will be developed in conjunction with stock raising or dairying.

During the year much of the initial developmental work was completed. Buildings and facilities were constructed and irrigation water supplied for areas already designed. Pending completion of channels and drains, trials with rain-grown crops were conducted during the summer.

In maize studies which embraced investigation of varieties, spacings and fertilizers, good yields are anticipated under the favourable climatic conditions experienced. Some supplementary irrigation during a dry January period would probably have improved crop production.

Preliminary trials with peanuts gave yields ranging from 750 lb. per acre (in shell) for Red Spanish up to 1,591 lb. per acre (in shell) from Virginia Bunch. There was little response to applications of 2, 4, and 8 cwt. of a complete fertilizer mixture per acre. Initial trials with cotton included December and January plantings but inadequate moisture was stored from the wet season to carry the crops through successfully. Out-of-season plantings will be made following irrigation in July and other sowings will be made at intervals during the main season.

Leguminous green manure crops were sown and later ploughed in as part of the land preparation for extensive testing of pasture legumes and grasses.

Work for the layout of border check irrigation is proceeding well, and in addition to grading and check banking, construction of head ditches, tail drains, checks and culverts is now well advanced.

Assistance and advice from the Irrigation and Water Supply Commission in the establishment and equipping of this centre were greatly appreciated.

BOTANY SECTION

Work continued along three main lines: (1) researches into the structure, distribution, relationship and nomenclature of plants occurring in Queensland; (2) advisory work and field research on poisonous plants, ecology, distribution and control of weeds and woody plants, and the utilization of edible trees; and (3) identification of grasses, weeds, poisonous plants, trees and other plants submitted by officers of State and Commonwealth departments and the general public.

SYSTEMATIC BOTANY

The aim of research in this field is to obtain a complete knowledge of the flora of the State and eventually to incorporate this knowledge into a new *Flora of Queensland* which will enable non-botanists to identify plants. This is a long-term project. Towards this end, taxonomic research was continued in the genera *Acacia, Boronia, Carpobrotus, Eremophila, Galbulimima, Hakea, Melaleuca, Micromyrtus, Micraira, Myoporum, Plectranthus, Restio, Scleria, Stylidium, Triglochin,* and the family *Lauraceae.*

During the year the Cooktown orchid was adopted as the floral emblem of Queensland. The correct botanical name of this orchid has always been in some doubt and research into the taxonomy and nomenclature revealed such confusion that it will be necessary to study the plant in its wild state before the range of variation can be determined and precise identification can be made.

The species of *Acacia* collected by the Archbold Cape York Peninsula Expedition were identified. The Cyperaceae collected by the 4th Archbold Expedition to New Guinea were determined at the request of the Arnold Arboretum, and at the same time a collection from New Caledonia was identified.

A critical study of the taxonomy of *Sorghum almum* was begun, mainly to find suitable characters by which to distinguish the seed from that of other sorghums, cultivated and naturalised, with which it is likely to be confused.

Study of the history and countries of origin of plants naturalised in Queensland revealed that although their number had risen from 132 in 1883 to 578 in 1959, the percentages from each of the major geographical regions of the world remained unchanged. It is interesting to note that although 60 per cent. of all our naturalised plants are natives of the Old World, nearly all the major weed pests in the State are native of the Americas.

Botanical exploration included brief visits to the Blackdown Tableland, poorly known botanically, and to the Cooktown area, where little botanical collection has been done since the very early days.

A member of the staff (Dr. S. T. Blake), as chairman of a Committee appointed to examine the practicability of preparing the proposed new *Flora of Australia,* attended a meeting of botanists in Perth. The Committee's report was sent to the Prime Minister through A.N.Z.A.A.S.

The following botanical papers were published during the year:—"New or Noteworthy Plants, chiefly from Queensland—I", by S. T. Blake; "New Species of and Notes on Queensland Plants—IV", by L. S. Smith; and "Strangers within the Gates (Naturalized Plants in Queensland)", by S. L. Everist.

BRIGALOW

The brigalow survey was extended northwards through the Biloela-Rockhampton area to as far north as Collinsville. Most of this country is devoted to cattle production so that pulling, burning and sowing down to improved pastures is now the normal method of control.

The survey showed that pulling with cable and chain gave better results than either cable or chain alone. Fewer suckers were noted on areas where burning was delayed for more than nine months after pulling than on areas burnt immediately. It was apparent that success of pasture establishment depends to a large extent on the thoroughness of the burn and that patchy burns result in regrowth of native grasses and brigalow suckers.

Time of burning and sowing also appears to influence profoundly the development of new suckers. Burning late in the year, followed by immediate sowing and early germination of grass, results in less suckering than early burning with its consequent lapse of time between burning and grass germination. Evidence strongly suggests that a good cover of Rhodes grass can largely suppress brigalow suckers. *Sorghum almum* appears to be less effective in doing this. The survey also showed that even in well-grassed paddocks some brigalow suckers do persist, so continuous careful pasture management is needed to prevent deterioration of the sward, which would lead to sucker dominance. Overstocking, injudicious firing and drought conditions can swing the balance in favour of brigalow.

The series of aerial spraying trials on brigalow suckers in the Hannaford-Meandarra area and in the Westmar-Bungunya area was completed in November. A preliminary assessment of the earlier sprayings in February and June, 1959, indicated that a total volume of ½ gal. per acre is insufficient for effective application, irrespective of the amount of 2,4,5-T used. A volume of 1 gal. per acre gave better results but in most cases did not appear to be good enough for commercial use. Volumes of 4 gal. and 8 gal. appear to be equally effective at rates of 1 and 2 lb. 2,4,5-T acid aquivalent per acre. At a volume of 2 gal. per acre the picture is still obscure and further observations are needed to determine the effectiveness of these applications. Plots sprayed in January carried a good body of ground vegetation but those treated in June had very little ground cover.

A new spraying trial was begun in the Westmar-Bungunya area in March. This was the application of 2,4,5-T and 2,4,5-TP in oil at different volumes and at different rates on young suckers which came away following pulling in November and burning in December. Treatments of this type gave good results in 1954. The current trial is more extensive and is designed to test the feasibility of controlling young suckers by low-volume aerial spraying.

MULGA

In March, 1960, a rapid survey was made of parts of the mulga country to study the response to patchy rains in November and February, to examine stands of mulga which germinated in 1947, and to compare the condition of the mulga after the drought of 1957–1960 with that after the drought of 1944–1947.

In most districts, it was obvious that the mulga had survived the present drought better than that of 13 years earlier, no doubt because of the accumulation of soil moisture over the 10 years of abnormally high rainfall from 1947 to 1956. There appeared to be no large-scale dying out of mulga such as was observed in 1946.

Hand cutting was still being used to a limited extent but most mulga was being pushed, either with a bull-dozer or with a front-end loader on a wheeled tractor. Most mulga knocked down early in the drought (1948–1958) was growing again, and on one property south of Morven this regrowth was up to 4 ft. high. Mulga on the same property pulled later (1959) showed very little regrowth. This is consistent with a gradual diminution of subsoil moisture such as might be expected under a dense stand of trees. In the present drought most of the mulga had been well utilised and bone-flour supplements were very widely used with beneficial effects. On one property more than 80 per cent. of lambs were marked from ewes which had been fed almost exclusively on mulga from prior to mating until after the lambs were dropped.

Beneficial effects from thinning out dense stands of mulga were noted on several properties. On one property on Nebine Creek, large areas of mulga were pulled over in 1957. Many of the prostrate trees had produced leafy branches which were being eaten by sheep and there was a prolific growth of grass and herbage, particularly in the shelter of the masses of branches from the fallen trees. The carrying capacity of the country has been greatly increased by the pulling and there seems little doubt that where mulga is growing so thickly that ground vegetation is sparse, pulling during good seasons would pay dividends later, provided the pulled material was not burnt. On an area pulled and burnt in 1957 sheet erosion up to 2 in. deep occurred and little grass or herbage grew.

FEATHER-TOP WIRE GRASS

A preliminary survey of the encroachment of feather-top wire grass (*Aristida latifolia*) in open grassland at Wyandra and St. George showed that encroachment followed a series of unusually wet seasons. On the Warrego River the problem is associated chiefly with country that received some runoff from the surrounding land or is subject to flooding. In the St. George district the worst infestations are on broad flats subject to occasional flooding. On the Warrego, more than 50 per cent. of the feather-top tussocks were dead but most of those in the St. George district were still alive. There was less feather-top in paddocks grazed by cattle and horses, with or without sheep, than in those grazed by sheep alone. It was noted that cultivation destroys the grass and cropping of badly infested paddocks seems to be the best method of control in the St. George district. Further study of this grass over the whole of its range of habitat is warranted.

CHARLEVILLE TURKEY BUSH

In the Charleville, Quilpie and Thargomindah districts several areas formerly heavily infested with Charleville turkey bush (*Eremophila gilesii*) were inspected. Around Charleville, infestations are now patchy. On some properties the plant is still abundant, particularly on worn areas subjected to heavy grazing and trampling by sheep. In the Quilpie and Thargomindah areas, most plants in the dense infestations of the 1950-1957 period are now dead. However, in some places where rain was received in November and in February, new seedlings have appeared under the dead bushes and further infestations are likely to develop if there is sufficient rain to maintain those plants for another season.

WEEDS

An unusually wet spring in south-eastern districts resulted in the appearance of a number of weeds rarely seen in Queensland. Two plants not previously recorded from Queensland made their appearance during the year. These were yellow hawkweed (*Tolpis barbata*) from Wallangarra and *Sorghum propinquum* from Yungaburra. The former is naturalised in southern Australia. The latter is widespread in Malaysia and the Pacific Islands: it is a tall grass with extensive rootstocks similar to Johnson grass and could possibly become a serious weed in tropical districts. The Yungaburra plants are reported to have come up from seeds introduced in packing material from New Guinea. Action has been taken to keep this area under observation.

Horned African cucumber (*Cucumis metuliferus*) was reported as a weed for the first time—from sugar-cane in the Mulgrave area, where control has been obtained with 2,4,5-T at ½ lb. per acre.

Slight extensions of known range were recorded for several noxious weeds, including groundsel bush (*Baccharis halimifolia*), Russian knapweed (*Centaurea repens*), Paterson's curse (*Echium plantagineum*), Harrisia cactus (*Eriocereus martinii*) and Crofton weed (*Eupatorium adenophorum*). These were reported to the Department of Public Lands for appropriate action.

Seasonal conditions appeared to be particularly favourable for blue heliotrope (*Heliotropium amplexicaule*) and European bindweed (*Convolvulus arvensis*), and rapid spread of these weeds was reported from several districts in south-eastern parts of the State. Johnson grass (*Sorghum halepense*) was received from Boogan, near Innisfail, where it was infesting young sugar-cane, apparently as the result of introduction of seeds with green manure seeds or with second-hand fertilizer bags. In the Brisbane district a further trial on Johnson grass using dalapon and dalapon plus ATA confirmed earlier findings that dalapon was most effective as three sprayings each of 5 lb. per acre applied at weekly intervals. A single spraying with 5 lb. dalapon plus 1 lb. ATA gave results promising enough to warrant further trials with this combination.

Common nutgrass (*Cyperus rotundus*) was received from a cutting through which the main irrigation channel passes from the Tinaroo Dam. This occurrence was drawn to the attention of the Irrigation Department with a strong recommendation that the patch be destroyed to prevent spread to irrigated farms.

POISONOUS PLANTS

Examination of stomach contents was carried out in connection with about 80 cases of suspected plant poisoning of stock and in some instances the cause of death was determined or confirmed by this means. Altogether more than 35 cases of suspected plant poisoning were added to the poisonous plants files, some providing further field evidence of toxicity, others involving new suspects.

Two species were reported to have caused serious illness in humans—purple angel's trumpet (*Datura metel*) in two young children, and candle-nut (*Aleurites moluccana*) in a 7-year-old girl.

The good spring rains produced abundant early plants of Noogoora burr (*Xanthium pungens*) and stock losses due to it were more prevalent than usual. Several cases of poisoning by crownbeard or wild sunflower (*Verbesina encelioides*) were reported and in most instances fragments of this plant were recovered from the stomach contents.

HERBARIUM AND LIBRARY

About 8,000 specimens were mounted and incorporated in the herbarium and 500 additional type specimens were segregated for transference to the fireproof annexe. A total of 2,863 specimens were sent out and 3,109 were received on loan and exchange. Sorting of 27,000 specimens received on exchange in recent years was completed. They were arranged in boxes on temporary shelving in the back store-room awaiting incorporation in the main herbarium, which is too overcrowded to house them.

In addition to periodicals and reprints, 50 new and second-hand books were added to the library and during the year 189 volumes were bound. The cataloguing of all reprints was completed and several hundred photographs were sorted and mounted.

VISITING BOTANISTS

Visiting botanists who worked in the herbarium included Dr. R. Thorne, Iowa; Dr. V. Cheadle, California; Dr. L. J. Brass, Florida; Dr. N. H. Brittan, Perth; Mr. R. T. Robbins, Canberra; Mr. M. Lazarides, Canberra; and Dr. R. E. Holttum, Kew, England.

ENTOMOLOGY SECTION

Throughout the State, generally fair growing conditions for crops were reflected in the low overall losses due to pest activities. Populations of many of the usual pests were either negligible or amenable to reasonably economic chemical control. There was, however, an unusually large number of localised and sporadic outbreaks, in some instances of relatively minor pests, which caused concern to the individual and appreciably increased advisory work. On a crop basis, pests of cotton, tobacco and pastures received urgent detailed research attention, while at the same time other long-term projects were continued.

An entomologist commenced duties at St. George, in south-western Queensland, in November, and there are now nine field stations concerned with pests of many crops, some of which are grown under a wide range of conditions within Queensland; at two of these biological studies associated with fauna conservation are also being undertaken.

The number of insecticides and miticides now available for commercial use has increased considerably the difficulties associated with chemical control of pests under tropical conditions. A long-range plan to assist orchardists and farmers in this regard is being implemented, and it is anticipated that by the end of 1960 a well-equipped laboratory, to supplement field work, will be functioning.

DECIDUOUS FRUITS

In the Stanthorpe district, codling moth (*Cydia pomonella* (L.)) and light-brown apple moth (*Austrotortrix postvittana* (Walk.)) were only moderately active although some orchards suffered heavy losses. A mite build-up occurred late in the season, and woolly aphid (*Eriosoma lanigerum* (Hausm.)) remained active in some apple blocks. A large series of trials concerned with dimpling of apples, screening of pesticides, oil sprays and complete control programmes was completed. As in the previous year, low pest populations in some of the trials precluded conclusive results. The sound information obtained should be, however, useful during the coming season to the orchardist with pest problems for which present standard control recommendations have been found inadequate.

The fig leaf-hopper (*Dialecticopteryx australica* Kirk.) and the fig leaf beetle (*Galerucella semipullata* (Clark)) were prevalent in sub-coastal and western districts. Fruit-sucking moths (*Othreis* species), not present in pest proportions in citrus orchards this year, caused severe damage to apples at Herberton, N.Q. About 1,000 trees were involved and more than 50 per cent. of the crop was lost.

TROPICAL FRUITS

Insecticide screening and other trials in North Queensland banana plantations, particularly with rust thrips (*Scirtothrips signipennis* Bagn.), scab moth (*Nacoleia octasema* (Meyr.)) and nematodes (5 species) yielded worthwhile results, and relevant technical and extension articles are being prepared. Efficacies of the newer insecticides tested did not compare favourably with those of standard recommendations (BHC/DDT dust or DDT spray). Ineffective pest populations were encountered in South Queensland insect pest control trials.

Following the completion of trials over three seasons, firm recommendations for the control of nematodes (3 species) in South Queensland pineapple fields were published. Present investigations are designed to assist in the control of these pests where soil fumigation is neither economical nor practicable. Nematode populations in papaw plantation trials in the Central districts were insufficient for statistical differences between treatments and control.

CITRUS

Red scale (*Aonidiella aurantii* (Mask.)) was a troublesome pest of all varieties in inland and coastal orchards, and white wax scale (*Ceroplastes destructor* Newst.) produced moderate numbers of young stage as autumn hatchings from survivors of early summer sprays. Maori mite (*Phyllocoptruta oleivora* (Ashm.)) was active in several districts. Depending to a considerable extent on measures implemented and thoroughness of applications, most infestations were reasonably well controlled. Routine checks show that parasitism of the citrus gall wasp (*Eurytoma fellis* Gir.) is still

high in the Nambour district. Research projects for the past season were confined to screening trials against mite species.

FRUIT FLIES

In Brisbane areas, October rains stimulated fruit fly activities, which remained intense for some weeks, and in the Central districts during January mangoes, grapes and tomatoes were damaged. Although unusual infestations in commercial fruits were recorded, and these included some out-of-season catch crops, losses caused by these pests throughout the State were not high. Research in the field was to some extent curtailed by lack of suitable pest populations; otherwise a full programme, including screenings of newer insecticides, was maintained. Opportunities were taken to extend ecological studies into south-western Queensland. A second supplementary series of Queensland records for the Dacinae was published.

TOBACCO

The tobacco looper (*Plusia argentifera* Guen.), and budworms (*Heliothis armigera* (Hubn.) and *H. punctigera* Wallngr.) were easily controlled even when in numbers potentially capable of inflicting serious losses. In Far Northern districts an upsurge of leaf-miner (*Gnorimoschema operculella* (Zell.)) occurred late in the season and persisted in late crops, many of which were heavily infested. This pest was present in early crops in the Burdekin district but at this stage only occasionally caused serious damage. As plants increased in size, some farmers resorted to aerial spraying though many used modified booms to improve coverage. In south-western Queensland leaf-miner in heavy populations attacked transplants in one locality; these infestations were controlled by routine spraying. Later, this pest and mites (*Tetranychus* species) were active near Inglewood.

Research projects with insect pests included a series of detailed screening trials against leaf-miner using a wide selection of materials. Results of these demonstrated that (1) at the practical level this pest has not acquired resistance to insecticides in commercial use, (2) one of the new materials (WL1650) is more efficicacious than present recommendations, and (3) as for the successful control of other insect pests of tobacco, thorough spray coverage is essential.

Nematode investigations were concerned with the effects of methyl bromide on seedlings, and EDB dilution rates.

A technical article covering insect pest investigations over a number of years is in the press, a recommended control programme for the coming season was distributed to farmers, other relevant manuscripts are being prepared, and facilities for further long-term research were assembled.

FORESTRY

The volume of routine identifications of insects infesting timber, and enquiries, continued at a high level. A close watch is being kept on relevant problems in the field. An unusual record was the infestation of kauri pine plantations by a species of Margarodidae. This previously unknown insect appeared over extensive areas in widely separated plantations, particularly in the Amamoor and Glastonbury districts. A large hatching coincided with the spring flush, and mass attack on the immature leaves killed practically all foliage, leaving leaders denuded. Athel trees, planted as windbreaks in western districts, are being damaged frequently by adults of the auger beetle (*Bostrychopsis jesuita* Fabr.). Severe damage during November to 2-year pines (hoop and klinki) in a Danbulla planting was caused by *Melomys cervinipes* Gould, a rain-forest rat. Investigations on bagworm (*Hyalarcta hubneri* (Westw.)) at Passchendaele continued, and results from control trials against the cedar shoot borer (*Hypsipyla robusta* (Moore)) in the Mary Valley are most promising. Post-fumigation checking of timber samples from imported houses infested by the European house borer (*Hylotrupes bajulus* L.) was carried out as required. Plans for further long-term work on forest pests are being implemented.

NEMATODES

In addition to field investigations mentioned elsewhere in this report, further attention was given to these pests in strawberries, ginger and potatoes. Surveys throughout the State continued, and results include several new species (some of the descriptions have been published) and many new records. Recently, a new species producing terminal swellings of citrus roots was found. An infestation of the clover cyst nematode (*Heterodera trifolii* Goffart) caused white clover 'sickness' at Maleny: this is the first record of the species in Australia. The beet nematode (*Heterodera schachtii* Schmidt) was discovered in one locality, and as in some countries this species in a serious pest the necessary preliminary steps in control were taken.

PASTURES

Damage by white grubs (Melolonthidae), funnel ants (*Aphaenogaster* species) and the grass caterpillar (*Psara licarsisalis* (Walk.)) in dairy pastures was of little economic importance. During the spring, grass grub or webworm (*Oncopera mitocera* (Turn.)) caused severe damage in the Malaan area of the Atherton Tableland: rough terrain and conditions made the application of chemical controls difficult. During late December, attacks declined and good growth of pastures masked the dispersed damage occurring at the time.

Further large-scale trials concerned with the control of pasture pests on the Atherton Tableland were established, and ecological studies of two of the three major pests are being intensified. Investigations of the control of seed-harvesting ants in western pastures were finalised for the present. Firm recommendations can now be made for protecting buffel grass seed.

VEGETABLES

Tomatoes were damaged by fruit fly in areas near Brisbane and Rockhampton, and by the tomato mite (*Vasates lycopersici* (Massee)) and stem borer (*Gnorimoschema* species) at Ayr, Bowen and Rockhampton. As in recent years, the main difficulties in the control of vegetable pests were associated with out-of-season crops and catch crops which did not receive routine attention and existed only because of favourable weather conditions.

Probably at the present time the most pressing economic problem confronting vegetable growers in Queensland, so far as insect pests are concerned, would be the sorting out, on sound lines, of the large number of pesticide materials offering: in labour requirements alone this would require a major effort.

Investigations during the year included farm trials with cabbage and bean pests. A thorough ecological study, as well as control trials, of bean fly (*Melanagromyza phaseoli* (Coq.)) is under way in the Nambour district. The objective is not only improvement in the economic control of this pest in small crops, but also in the wider field of leguminous cover crops.

COTTON

In the Burdekin district rough boll worm (*Earias huegeli* Rog.) severely damaged most crops. In the Central districts a variety of pests was recorded. Pink boll worm (*Pectinophora scutigera* (Hold.)) was severe in late bolls in the Theodore area and at Biloela. Looper (*Anomis flava* Fabr.) was widespread: control with endrin as low as ¼ lb. per acre, however, was excellent (DDT up to 2 lb. per acre gave poor results). Jassids caused injury in isolated pockets. On the Darling Downs crops did not come up to expectations, and heavy sheddings of squares and small bolls occurred during hot dry weather in late January and early February. Infestations of rough boll worm were general during February and March. *Heliothis punctigera* Wallngr., tip worm (*Crocidosema plebeiana* Zell.) and jassid (*Austroasca viridigrisea* Paoli) were also recorded. Crops in the St. George district were retarded by growing conditions, and during January heavy falls of squares and bolls, only some of which were insect damaged, helped reduce further the yield potentials. On most farms much of the remaining crop was attacked by rough boll worm, which was present in large numbers. Some growers prevented excessive damage by spraying with endrin, while others using DDT, diazinon, dieldrin, "Metasystox" and "Sevin" failed to prevent severe losses.

Yield trials, using fertilizers and spray programmes, were carried through at Ayr, Rockhampton, Biloela and St. George. Results as pounds of seed cotton per acre ranged from control 25, treatments 442-447, to no significant differences among insecticidal treatments in a crop exceeding a ton. Studies on pest status, and the relationship between plant behaviour and crop yield reductions, which may be due to injury by insect attacks, were continued under a wide range of agronomic conditions. Insecticide screening trials, mostly against rough boll worm and looper, were carried out at Biloela and St. George. Efforts are being made to evaluate and publish data collected, as well as to provide extension information on pest control for use during the coming season.

MISCELLANEOUS FIELD CROPS

On the Darling Downs, dry conditions suited the development of blue oat mite (*Penthaleus major* (Duges)) infestations, while a second species (*Petrobia latens* (Muller)) also checked growth in cereal crops from Jandowae to Pittsworth. Fifteen materials in two trials were screened but results against this complex were unsatisfactory.

Unseasonable warm weather in August promoted early emergence of *Heliothis* species and most linseed crops were infested before flowering. These pests were again active in late-maturing crops during October but no difficulties in control with DDT at ¼ lb per acre were reported. Results from a field trial at Capella during September demonstrated that (1) diazinon is of no value for the control of *Heliothis*, and (2) resistance to DDT has not been acquired by *Heliothis*. An extension article covering control of *Heliothis* species in linseed on both the Darling Downs and Central Highlands was published.

Armyworm (*Pseudaletia unipuncta* (Haw.)) infestations were widespread, but relatively light and sporadic. Spectacular leaf injury was inflicted on sorghum in the Allora-Pittsworth area during January but yields were not materially affected. Considerable head cutting in French millet and panicums was reported on the central Darling Downs in March, and DDT spraying was extensive.

Soil-inhabiting larvae of a moth, which has been bred, destroyed a field of wheat at Brookstead. Sorghum midge (*Contarinia sorghicola* (Coq.)) damaged crops flowering during last February in the Toowoomba district, and a screening trial was established at Formartin. A technical paper on the chemical control of sorghum midge was published during the year.

In late winter, mice (*Mus musculus* Linné) damaged wheat stands throughout the Darling Downs and as far afield as Warra, Goondiwindi and Swanfels. These pests sheltered in soil cracks, and chewed stems in near surroundings. Numerous unconnected damaged areas occurred throughout fields, and in some instances losses were appreciable.

MISCELLANEOUS

Early maize plantings on the Atherton Tableland grew rapidly under ideal conditions, and *Heliothis* and armyworms caused severe damage during December. Some aerial spraying (DDT 1 lb. per acre) was carried out and the infestations waned during January. The yellow-winged locust (*Gastrimargus musicus* (F.)) was noticeable on a Georgetown holding in late December, and in grasslands near Home Hill during March. The mite *Tenuipalpus californicus* Banks defoliated passion vines at Townsville, Ayr and Home Hill. During February and March experimental soybean plantings at Millaroo were damaged by *Zygrita diva* Thoms. (Cerambycidae) boring in the stems, and by *Lamprosema abstitialis* Walk. (Pyraustidae) attacking the foliage. There were no significant infestations in a sweet potato weevil (*Cylas formicarius elegantulus* (Sum.)) control trial established in the Rockhampton district. Yellow peach moth (*Dichocrocis punctiferalis* (Guen.)) caused severe losses in some seed crops of Poona pea in the Callide Valley during March. The greenhouse thrips (*Heliothrips haemorrhoidalis* (Bouchè)) was the subject of many enquiries from home gardeners. *Selanothrips rubrocinctus* (Giard) was recorded for the first time on avocado in Queensland. Severe infestations of red spider (*Tetranychus* species) were noted on peanuts at Dalberg.

Studies on Coccoidea, Agromyzidae, Dacinae (systematics and cytology), Thysanoptera, Aphididae, Acaroidea, scarabaeoid larvae, and *Heliothis* species were continued, and further articles were published or prepared for publication.

BEEKEEPING

Good conditions during the second half of 1959 resulted in large crops of choice honeys. The harvest included, for the first time in three years, quantities of the excellent honey from yellow box (*Eucalyptus melliodora*).

Extension work covered 2,707 colonies in 55 apiaries in 17 localities as far north as the Atherton Tableland.

Nosema disease was recorded in apiaries at Parkhurst and Goomburra; European foulbrood in two apiaries at Rockhampton; and American foulbrood in an apiary at Marmadua. The following were found in consignments of queen bees: Nosema disease from the United States of America, and Italy; the mite *Acarapis woodi* (Rennie) from the United States of America, Italy and New Zealand; and a sarcophagid larva from Italy. These quarantine interceptions have increased considerably the routine work of the Adviser in Apiculture and entomologists.

At March 31, 1960, the end of the beekeeping year, 1,430 beekeepers were registered, compared with 1,319 for the previous year. It is the highest number recorded under legislation.

FLORA AND FAUNA CONSERVATION

By the end of the marsupial skin year (December 31) 2,068 permits and licenses were issued under *The Fauna Conservation Act of* 1952, and 506,795 skins were sold. Since January 1, 1960, 576 tons of kangaroo meat, processed from an estimated 45,337 carcasses, have been exported. During the year 29 honorary protectors were appointed, and 12 prosecutions for breaches of conservation and protection Acts were recorded.

The publication of information on sanctuaries and the preparation of material and maps continued. This basic phase of a consideration of sanctuary requirements throughout the State is nearing completion, and the next phase, that of sanctuary surveys, is receiving some attention.

Centred at Townsville and Brisbane, research on wild ducks and other water-fowl continued. Ecological studies concerned with practical aspects of conservation under local conditions are making progress. Bags of game birds during the open season were neither heavy nor easily obtained.

Field and enclosure work with marsupials was started in south-western and North Queensland.

PLANT PATHOLOGY SECTION

Heavy late spring rains in 1959 resulted in epidemic development of a number of common fungous diseases, particularly in vegetable crops. In contrast, the usual wet summer season was largely replaced, especially in southern districts, by heat-wave conditions. Some physiological disorders such as a leaf scald in beans were the result. One interesting development following the hot dry February was the exceptionally early appearance of black spot (*Phoma citricarpa*) on the exposed surface of the fruit of a number of citrus varieties some months before they were fully mature.

CEREALS

A new physiological race of wheat stem rust was reported in last year's report; since then two new races have appeared. One of these was identified by Professor I. A. Watson as a new virulent strain, 34-3, destroying the resistance of Gabo and *Triticum timopheevi*. The second, which behaves as 21-2 on normal varieties, has, however, the ability to attack adult plants of Spica. While the overall performance of Spica was satisfactory, some appreciable infections of stem rust occurred in rust-prone areas. The ability of Queensland to originate new biotypes of stem rust and to initiate infection of the wheat belt with these is giving cause for concern. On the past season's performance, Hopps, Kenora, Lawrence and Festival are the commercial varieties now showing satisfactory stem-rust resistance.

Fusarium crown rot was again serious in some wheat areas. It is now possible to state after a series of field observations that the adoption of recommendations made in 1955 for the employment of a long fallow followed by sowing to one or two resistant species gives a marked reduction in disease incidence. Lawrence and Festival have retained better resistance to this disease than other varieties. Examination over nine seasons of the severity of crown rot in relation to seasonal conditions shows that a severe outbreak is associated with below-average rainfall during the growing season rather than the reverse, which might be expected.

Sclerotium rolfsii, a fungus with a wide host range and widely distributed in Queensland, has been recorded only occasionally on wheat but it appeared in the past year in epidemic proportions in an irrigated summer-increase wheat sowing in the Brookstead district. In one block of 10 acres the estimated incidence was 40 per cent. The disease produces a collar rot, crown and root rot condition with resulting empty heads or heads with lightweight shrivelled grain.

Tropical maize rust (*Puccinia polysora*) was definitely identified by the Commonwealth Mycological Institute from material collected during the severe epidemic of maize rust on the Atherton Tableland last year. A close watch was kept on the rust position during the past season. Rainfall on the Tableland was far less than in the previous year. Early in February tropical rust was evident but no damage resulted. By early March the disease had spread considerably but still had not caused appreciable leaf loss. By the middle of April the disease reached epidemic proportions and killed older leaves rapidly. Early crops escaped damage but pinched grain and lower yields seem inevitable from the epidemic in late March and April.

Observations were made on disease incidence in a large number of inbreds and single and double cross hybrids in a trial grown under the supervision of Agriculture Branch officers at Tolga. Some differences in susceptibility to *P. polysora* were noted in inbred material, which may be of interest to maize breeders.

Varying degrees of susceptibility to brown spot (*Physoderma zea maydis*) were also shown in this trial. This is a serious disease of Tableland maize crops, causing lodging, leaf sheath rot and leaf necrosis. Any programme for breeding disease-resistant hybrids for the Tableland should take into consideration the importance of brown spot as well as tropical rust.

PEANUTS

Disease incidence in peanuts was lower than usual. Seedling losses were generally light and only one serious outbreak of crown rot (*Aspergillus niger*) was recorded. Stem rot caused by *Diplodia natalensis* occurred on a number of farms and at least one case of serious losses in stand resulted. This was associated with infertile, over-cultivated soil. The outbreaks followed the severe heat-wave and it is likely that invasion by this fungus followed heat injury to the stems at ground level.

Wilt was widespread and the results of numerous isolations point to *Verticillium dahliae* being the major cause. When present in the peanut crop this disease appears to render the plants much more susceptible to moisture stress. It occurs more frequently on the better class of peanut soils and seldom in crops on poor forest and sandy soils. Recently *V. dahliae* was isolated from two weeds common on the good soils—*Tagetes minuta* and *Anona cristata*. The occurrence of the disease on good soils could be associated with the weed population. Cross-inoculation tests carried out with isolates of this fungus from other hosts in Queensland have confirmed its wide host range.

Virus diseases have been widespread in peanuts in the past season. Work carried out in conjunction with C.S.I.R.O. officers confirmed that tomato spotted wilt virus is the cause of the disease formerly known as chlorosis. The presence of this virus was also established in at least two common weeds of this area. This disease caused up to 10 per cent. loss in some areas over the past season. "Bunchy plant" (tomato big bud virus) was sporadic in occurrence and caused no economic loss. Rugose leaf curl also occurred occasionally.

TOBACCO

The incidence of blue mould at the site of last season's spray trials was abnormally low and consequently the treatments were not subjected to a severe test. Some interesting observations were made. Best results were obtained from a weekly high-volume spray of zineb plus benzyl salicylate commencing one week after planting out. Almost as good control of both mould and stem infection was obtained by weekly misting with water-based zineb/benzyl salicylate concentrate.

Leaf harvested from plants sprayed or misted with this formula and with the inclusion of cottonseed oil cured quite satisfactorily and showed none of the abnormalities which were associated with the use of methyl salicylate the season before.

In a trial designed to see if any differences resulted from a seedbed treatment involving fumigation every third night as compared with every second night, no differences were apparent in the amount of leaf mould damage or stem infection in field plantings made with seedlings receiving these two treatments. This confirmed results from the previous season's trial, which showed no evidence of a masked infection in seedlings receiving benzol treatment every third night.

A comprehensive blue mould survey was carried out in all northern tobacco growing districts and confirmed many of the observations made in the previous year's survey. Seedbed infection was restricted to a low percentage of farms, where inadequate fumigation methods were practised. The common causes for such failures were noted and advice based on these observations is available.

The disease is carried over from season to season on volunteer plants, which can be found on all too many properties. An early field infection due to the planting of infected seedlings or the proximity of infected volunteer plants almost invariably leads to crop failure, but more important from a district point of view is the establishment of a concentrated source of inoculum early in the season. Outbreaks of mould in neighbouring farms are predictable following a study of such sources of infection. Row direction and row and plant spacing are important factors influencing the severity of leaf infection.

DECIDUOUS FRUIT

Spraying experiments in the Stanthorpe district confirmed previous experience that weekly or fortnightly applications of captan commencing one month before

harvest with a final spray one day before picking will significantly reduce brown rot (*Sclerotinia fructicola*). Examination of artificially inoculated and bagged fruit again showed that under Queensland conditions the majority of functional infections occur as the fruit is nearing maturity. However, at one site this year, appreciable infection was obtained by inoculating at the time of fruit set and when the fruit had attained full size. A post-harvest dip of inoculated fruit in either captan or mycostatin materially reduced subsequent brown rot development.

CITRUS

The citrus black spot spray experiment at Nambour was harvested and the yield figures submitted to statistical analysis. For black spot control all four sprays (home-made cuprous oxide 3:40; commercial cuprous oxide 1:40; copper oxychloride 1½:40; and zineb ¾:40) were effective, the coppers being somewhat better than zineb. For melanose the sprays were about equally effective. White oil (1:160) was included in each formula.

A final series of collar rot (*Phytophthora parasitica*) inoculations was made late in February on the various stocks remaining in the nursery rows at Kamerunga. When the results of this experiment are known a clear-cut picture of the resistance of the various stocks should be available. To examine the results of this nursery testing on a wider scale, arrangements were made for citrus rootstock trials to be established on five orchards in the Kennedy district, where Phytophthora root and collar rot has caused extensive tree losses in the past. The grafted trees for these trials were produced by the Horticulture Branch.

STRAWBERRIES

In an experiment at the Redlands Experiment Station a 50 per cent. increase in yield of marketable fruit was obtained by regular fortnightly spraying with captan (2 lb. of the 50 per cent. product in 100 gal. water). Zineb, maneb and copper oxychloride were also tested but captan was outstanding. This increase was due mainly to the control of grey mould (*Botrytis* sp.) and Gloeosporium fruit rot, but there was also a reduction in flower blight (*Botrytis* sp. and *Gloeosporium* sp.) and a general improvement in the amount of rotting plant material in the captan-treated plots.

PASSIONFRUIT

A tip blight disease of passionfruit occurring in the Rockhampton and Bundaberg districts is being investigated. The virus responsible has been experimentally transmitted to passionfruit by the aphid *Myzus persicae* from naturally infected plants of the corky passion vine (*Passiflora suberosa*). The latter tolerates the virus to the extent of showing a mottle symptom only and in the districts above-mentioned may form an important source of infection.

BANANAS

A new development in the control of Cercospora leaf spot of bananas in North Queensland has been the use of air-blast machines to apply the copper oxychloride/white oil/malachite green formula. In addition, this method of treatment is coping quite well with leaf speckle and is superior in this regard to the technique of overhead spraying from mobile towers. The use of air-blast machines, where possible, has made the treatment of banana plantations for leaf spot and speckle control most economical. Dosages of 50–60 gal. per acre are employed without altering the original high-volume formulation, and at least eight acres per day may be treated.

Investigations concerning leaf speckle (*Mycosphaerella musae* (Speg.) Syd.) are now complete. In addition to determining the cause of this disease, considerable attention has been given to its control by fungicides. Actually it is readily controlled by the range of fungicides effective against Cercospora leaf spot. However, it is essential to have a complete and adequate deposit on the under-surface of the leaves. This explains why overhead spraying and low-volume misting as used for leaf spot are inadequate for speckle.

VEGETABLES

The main work with beans is an attempt to combine the resistances of Redlands Beauty (rust, anthracnose, common mosaic and halo blight) with those of 121-2-3 (rust and angular leaf spot). Two field plantings of current breeding lines were planted at Redlands Experiment Station for selection for rust and angular leaf spot resistance. Glasshouse tests were made to determine reactions to anthracnose, common mosaic and other diseases, while halo blight and common bacterial blight reactions were tested by pod inoculation. The results were used as a guide in the field selection work.

Tomato disease investigations have been along two lines, one concerned with the winter virus disease problems, mosaic and leaf shrivel (potato virus Y), and the other with a late spring and summer crop, in which foliage diseases and wilts are of major importance.

For the warm weather crop, resistance to Alternaria foliage and fruit spots was examined in a September planting of 21 tomato varieties and selections at the Redlands Experiment Station. Very wet conditions were experienced and useful information on field reaction to Fusarium wilt and target spot was obtained. Several lines performed well, the most promising being a Q2 x C2 hybrid. Further reaction to Fusarium and bacterial wilts is being examined in glasshouse pot trials.

The 1960 winter trial is still in progress. The best selections for leaf shrivel resistance from previous trials are being compared with P.I. 128887 from Dr. D. Walters, Bradenton, Florida. Two tomatoes of commercial type, Step 305 from Dr. Walters and Selection 59A from Arthur Yates & Co., are under observation for reaction to tobacco mosaic. Special precautions are being taken to exclude virus infection from sources other than the controlled inoculation at the prescribed time in order to obtain a true assessment of difference in reaction.

A disease of celery unlike anything previously seen on this host was recorded from two districts in the Brisbane area. Black sunken areas appeared on leaf stalks, mainly near the bases of the leaflets, where they frequently penetrated through the tissue in this region, cutting off and causing the death of the leaflets. Similar spots occurred on the young growth at the centre of the plant, in some cases causing death of the plant when infection spread to the crown. A species of *Colletotrichum* was associated with this disease and its pathogenicity was confirmed when typical symptoms were produced on three varieties of celery by artificial inoculation in the glasshouse.

A mosaic disease has been prevalent over the past few years in cucurbit crops grown in Brisbane and Gatton districts. In pumpkins especially it has been shown to cause a very appreciable reduction in yield. Cross-inoculation tests have now proved the cause of this disease to be watermelon mosaic. This virus was obtained from all specimens of pumpkin, watermelon, squash and rockmelon examined and was shown to be distinct from the cucumber mosaic associated with fern-leaf in tomatoes.

FORESTRY

Continuing the investigation of the organisms causing damping-off and root rotting in nurseries of *Pinus* spp. it was shown in glasshouse soil inoculation tests that *Phytophthora cinnamomi, Pythium ultimum, P. debaryanum* and *Rhizoctonia solani* can cause damping-off of *Pinus radiata* and *P. elliottii* seedlings. *Pythium vexans, P. helicoides, Fusarium oxysporum* and *F. solani* are frequently isolated but have caused little or no damping-off in pathogenicity tests. The two Fusaria cause rotting of the seed and seriously affect germination if the soil is inoculated before planting.

Phytophthora cinnamomi caused serious losses of large plants in two nurseries and rotted the roots of 1-year-old and 2-year-old trees of five *Pinus* species in pathogenicity tests. This fungus has been consistently isolated from the roots and surrounding soil under large *Pinus elliottii* and *P. taeda* trees in several localities and is strongly suspected of being a primary cause of some plantation losses of pines which occurred during the 1957 drought.

MICROBIOLOGY

Queensland farmers are becoming increasingly aware of the value of legume seed inoculation with Rhizobium. Over 12,000 cultures were distributed during the 12 months. In order to facilitate distribution, cultures were put up in four different sizes, the largest containing sufficient for 360 lb. of a large-seeded legume. Without this saving the above total would have been more than doubled. In addition to the inoculum distribution centres listed in the last annual report, Beaudesert, Goondiwindi, Monto, Biloela and Murgon are now being issued with bulk supplies.

It is of interest to note the proportions of the various types of culture sought by Queensland farmers. The relative percentages of the different groups as they were distributed is as follows:—

Lucerne	36
Clover	18
Field peas and tares ..	7
Other winter legumes ..	1
Cowpea	18
Centro	4
Soybean	4
Other summer legumes ..	12

Studies on the presence of genetic differences in *Centrosema pubescens* with respect to nodulation by standard strains of Rhizobium were continued. It has been shown that plant selections for poor or good nodulation breed almost completely true to these characters. However, particular Rhizobium strains can nodulate the poorly nodulating strains of *Centrosema*. Further data indicate that seedlings from profusely nodulating plant selections nodulate more heavily than most plants in a commercial seed lot.

Selection of Rhizobium strains with resistance to high temperatures was continued. Glasshouse trials showed that they are not inferior to normal strains with respect to nodulation and nitrogen fixation. Field trials in the wallum soils of Coolum are being carried out to test the ability of these strains to survive under very hot planting conditions.

CHEMICAL LABORATORY

Because primary production, striving for improved efficiency and increased yields, is compelled to depend so much on the use of chemicals, an increasing burden is placed on the resources and ingenuity of chemists to supply the necessary products for current and future needs. Intense competition exists today between chemical firms and is particularly marked in the realm of pesticides, weedicides and other agricultural chemicals. Thousands of new compounds are synthesised annually, and many reach the market after testing.

One of the functions of the Chemical Laboratory is to keep a check on the standard of products registered under the Agricultural Standards Act, and to cope with problems associated with the analyses of new and complex compounds and mixtures of compounds, the knowledge and skill of the analytical chemist are taxed to the utmost. It is only by the introduction of modern aids and modern equipment that these problems can be successfully handled. A special study of analytical problems associated with pesticide work is being made overseas by a staff member, Mr. T. Beckmann.

Other lines of investigation which have affected appreciably the work of the Chemical Laboratory during the year are those associated with (1) the quality of tobacco leaf, (2) special nutritional requirements of certain crops, and (3) factors affecting cereal quality. Demands for soil survey work have also been greater than usual.

The work of the various sections is detailed under separate headings.

GENERAL ANALYTICAL SECTION

This section exaxmined 1,609 samples during the year, comprised of pastures 1,008, stock foods 420, fertilizers 91, pest destroyers 67 and miscellaneous 23.

Agricultural Standards Act

Apart from pastures, most of the analytical work was in connection with samples which were submitted by the Standards Branch to determine their conformity with the Agricultural Standards Act. As many samples contain mixtures of complex organic chemicals for which standard analytical methods are not available, frequently the analysis becomes in itself a minor research project.

The quality of samples analysed for conformity with the Agricultural Standards Act was mostly satisfactory, with the notable exception of stock foods. With these products a great deal of variation was found, particularly in the important constituent of protein. Manufacturers are inclined to be careless of the uniformity of the protein concentrate which they use in mixtures, with the result that the marketed product often does not conform with the requirements of the Act. During the first quarter of the year 44 per cent. of the stock foods examined were deficient in protein. In general, the composition of fertilizers accorded well with the attached labels and where deviations occurred they could usually be traced to incomplete mixing. The quality of pest destroyers, which was bad in the early months of 1959-60, improved markedly throughout the year and during the last quarter all samples submitted were true to label.

Work on Linseed

Continuing the investigation into the properties of linseed which was initiated last year, 70 samples of seed comprising a number of varieties from three districts were analysed for their oil content, iodine number (Wijs) and refractive index. A correlation between the iodine number and the refractive index was achieved and this will simplify the analytical work. The Australian Standard Specification insists that raw linseed oil have an iodine number of not less than 177 and a refractive index of 1.4785-1.4805 at 25°C. Of the 70 samples examined only 10 passed all tests, the most satisfactory varieties being Bolley Golden, Marine, Newlands CSIRO and Viking CSIRO.

Pasture Work

Analysis of pasture samples from the Shell Chemical's experiments, where nitrogen as sulphate of ammonia was applied to pastures, was continued, as the results obtained in the previous year were sufficiently encouraging to require the collection of further analytical data. The results from the two years when finally examined should give valuable information relating to the economics of the application of nitrogenous fertilizers to pastures.

The carbohydrate analyses in connection with the growth-and-development project at "Brian Pastures" Pasture Research Station were completed and the results are being examined. Another project, a study of the nitrogen and carbohydrate status of tropical legumes, was commenced in co-operation with officers at "Brian Pastures."

Miscellaneous

Interesting results relating to the nitrogen content of soybeans from a nodulation trial conducted by the Pathology Section were obtained. Nitrogen was found to

vary from 1.86 to 2.80 per cent., showing that some of the strains of Rhizobium which were used in the experiment were much more efficient than others. Another sample of interest was of western spinifex grass, which gave the following analysis of water-free material:—

	%
Protein	5.3
Fat (ether extract)	8.1
Carbohydrates	47.1
Fibre	32.5
Ash	7.0
Lime (CaO)	0.18
Phosphoric acid (P_2O_5)	0.12

The fat content is high for a grass and comparable with some of the fodder trees. Protein is slightly below maintenance value.

The Chief Chemist visited "Brian Pastures" and Biloela Regional Experiment Station during the year to discuss with local officers the chemical problems associated with their experiments.

CEREAL SECTION

Wheat

Wet conditions at harvesting proved advantageous to the milling industry because protein was more extensible and the very hard wheats were less difficult to mill. Since the advent of machine baking more wheat of a lower protein content and higher extensibility is required. High-protein wheat, however, is necessary both for high-protein flour, which constitutes a section of the milling trade, and for export as whole grain.

A sample representing all the milling and export wheat harvested in the 1959-60 season had a protein content of 12.7 per cent. (flour protein 12.0 per cent.). The flour extraction rate was 74.1 per cent. and the bushel weight was 63½ lb. On baking a moderately good loaf resulted.

The average protein content of the 153 entries in the Best Bushel of Wheat Competition conducted by the Royal Agricultural Society (Toowoomba) was 13.7 per cent. (minimum 8.9 per cent., maximum 17.9 per cent.). This Competition affords an opportunity to assess the quality of wheat grown under commercial conditions. The results showed that the western wheat growing areas provided the superior wheat, as was also the case in the previous year's competition. A high standard of quality was maintained, with Spica, Charter and Koda being prominent. Festival again was disappointing.

With the assistance of the Junior Farmers' Organisation approximately 200 samples of wheat were collected. These were analysed for protein content, the average of which was 12.8 per cent.

The quality of new wheats from the plant breeding programme is kept under close observation, since the overall quality of wheat grown in this State is influenced by the release from time to time of new varieties. In general terms, most strains under consideration are capable of reaching 15 per cent. protein and the quality is strong to very strong. Difficulty is found in producing wheats with extensible protein similar to that in Spica and Lawrence.

Wheat quality was investigated in relation to the following programmes: urea spraying, cash crop rotations, depth of ploughing and superphosphate, varietal trials, method of fallow, time of planting, and crop rotation. In general, high-protein wheat is produced at the Hermitage and Biloela Stations, and the quality is usually strong. Most of the experiments are of a long-term nature.

The quality of wheat from a trial laid down by Agriculture Branch officers has been under investigation for several years. The area selected to be treated with urea was one moderately low in nitrogen but high in phosphorus and potassium. For the 1958 season the following protein contents were recorded.

Treatment	%
Control	10.4
1 cwt urea at sowing	13.1
2 cwt. urea at sowing	14.9
1 cwt. urea at flowering	14.4
2 cwt. urea at flowering	15.1

The treated plots gave strong wheat quality of a fairly good class but not proportional to the protein content.

The residual effects of urea applied in 1956 and 1957 were investigated in the 1958 season with the following results for protein content:

	Control	(all treatments) 2 cwt. level
	%	%
1956 residual	10.7	11.6
1957 residual	10.6	14.2

Quality poor in 1956 residual and in control of 1957 residual; quality fair at 2 cwt. level in 1957 residual.

The results are somewhat clouded by the choice of the variety Festival, which has inferior baking quality.

On an adjacent site when Spica, Gabo, Charter and Lawrence were treated with 2 cwt. urea at flowering, about 50 per cent. increase in protein resulted and an improvement in quality was effected. However, no strong wheat was produced.

In conjunction with the Agriculture Branch, urea was added to soil similar to that used in the above experiment. The rates of urea were increments of 8 cwt. per acre up to a maximum of 40 cwt. per acre. The grain from the control had 2.55 per cent. nitrogen (moisture-free) and from the 8 cwt. per acre plot 2.93 per cent. Higher amounts of urea gave similar results to those of the 8 cwt. per acre treatment. Yields (in grams per pot) for the corresponding treatments were 12.6 and 25.0. Very small increases were noted for the high levels. The plants were grown in a glass house and the soil moisture kept half-way between field capacity and wilting point. There were very small differences between treatments for bushel weight, 1,000 kernel weight and appearance.

Barley

Work on this cereal was initiated in conjunction with the Barley Marketing Board. Export shipments totalling 103 and representing feed, milling and malting barley were analysed for nitrogen. Samples were received from 33 depots and the range of nitrogen was from 1.76 to 2.25 per cent. (moisture-free). The nitrogen figures in general followed the wheat pattern for the same districts. The predicted extracts (an assessment of malting quality) varied from 96 to 99.8. The average bushel weight was 55 lb.

A survey of growers' samples was also undertaken and 145 samples were received. The protein (nitrogen x 6.25) ranged from 7.5 to 14.1 per cent. When the samples were grouped into districts—Dalby, North and Upper Central Downs, Lower Central Downs, Upper Southern and Lower Southern Downs—little variation from the mean (10.6 per cent.) resulted. Predicted extracts of 100 and over were found in 20 samples, the highest being 103½. Predicted extracts of 100 and over should be eminently suitable for malting purposes.

PLANT NUTRITION SECTION

Soil Surveys

During the year 31,500 acres in the Mareeba-Dimbulah district were surveyed in detail and mapped. Of this total, 29,000 acres were in the East Barron section, the remainder being west of Granite Creek.

In the East Barron area it was necessary to introduce a new land use group of soils designated A2, as although these soils are thought to be suitable for tobacco no-one has yet grown tobacco on them. They cover an area of 1,500 acres. Of the remaining soils, 3,500 acres were classified as suitable for annual and perennial crops, 2,000 acres as doubtful for tobacco because of basaltic origin, 1,300 acres as suitable for tobacco but requiring special irrigation techniques, and 4,500 acres as suitable for crops and pastures tolerant to waterlogging.

The survey of the 2,500 acres west of Granite Creek was made to select an area for experimentation in connection with irrigated pastures for cattle fattening. Of this area, 1,300 acres in the eastern portion were considered suitable and the soil types constituting it were mapped.

In addition to the above, a survey of the Cattle Creek section in the Mareeba-Dimbulah district was commenced. It is anticipated that this will be completed early in the next financial year.

Wallum Investigations

Further interesting leads have been obtained from the experimental work at Coolum Regional Experiment Station. As mentioned in last year's report, some observations were made on the grazing characteristics of certain centro/grass mixtures. The grasses combined with centro were molasses grass, *Paspalum dilatatum*, buffel (Biloela strain) and green panic. These were grazed heavily in the early summer of 1958-59 and again in early June 1959. Since then the pasture has not been grazed. Molasses grass has spread to all plots and is now dominant so far as the grasses are concerned. Centro recovered well from the grazing late in the season and produced excellent growth in the following summer. All grasses associated with the centro are dark green in colour and have evidently benefited greatly from the nitrogen supplied by the legumes.

In the grazing areas which were established several years ago, a further attempt was made to establish legumes with the summer grasses. In portion of the green panic block centro was sown in rows, and stylo was broadcast on another part following ploughing and reseeding to green panic. These germinated well and should make good growth next summer. Centro and *Lotononus bainsii* are now established in the 1956 block of para grass and both are doing well. The stylo in the buffel grass block (planted January 1957) has done particularly well and is now the dominant plant in the field.

In October 1959 an area of five acres of prepared heath land protected from the coastal wind was planted in acre lots to *Paspalum plicatulum, Paspalum dilatatum*, green panic, para and pangola grasses. Two 6 ft. wide strips were left free of grass in each acre and seeded to various legumes which received additional phosphorus and potassium fertilizers over that applied to the grass, whereas the grass got additional nitrogen. All grew well and in parts both centro and *Lotononus bainsii* had spread to 33 ft. in width by the end of May 1960 and penetrated the grasses on either side of the original strip. Of the other legumes, *Stylosanthes gracilis* grew particularly well but the growth of *Glycine javanica* was somewhat disappointing.

Attempts to establish winter pastures were made during the autumn and these are showing much greater promise than previously. Fair stands of cocksfoot, Preibie's prairie and *Phalaris tuberosa* in association with different white clovers were obtained.

A grass which is showing much promise on the wallum soils is Ronpha grass, a cross between *Phalaris tuberosa* and *Phalaris arundinacea*. Seed of this grass is not available but it is propagated by allowing it to stool out and then dividing it up for replanting. So excellent are its stooling characteristics that from one small clump obtained from C.S.I.R.O. for trial in April 1959 it was possible to plant out an area of 2 acres by March 1960.

Horticultural Crops

On the eucalypt forest type of wallum country small demonstration areas of pineapples, bananas and citrus were planted and these have grown very satisfactorily. An eighth of an acre of pineapples planted in the spring of 1958 was gassed to produce a uniform summer pack and the harvest from this was 3 tons of fruit, equivalent to 24 tons per acre. Of this, 22 per cent. were of 1st grade, 77 per cent. 2nd grade and 1 per cent. lower than 2nd. The crop received normal commercial amounts of fertilizer.

It can now be stated with confidence that there is no special problem associated with the growing of pineapples on either the forest or heath types of wallum country.

Soil Salinity Work

Experimental work continued in connection with saline soils in the Currumbin area and a good crop of mixed winter pasture grasses and clovers was grown on the mole-drained area. In January 1959, due to heavy rains and high tides the entry of sea water to the area occurred and caused further salting of the soils. A new flood-gate was installed during the year and this operated most successfully. By deepening and cleaning out the main surface drain and mole-draining a further small area the chloride content of the surface soil has been kept down appreciably.

Several traverses were made across the field in March 1960 to take soil samples for a check on chloride. The figures in Table 1 show the chloride content for four different positions spaced at intervals of 3 chains on the traverse as compared with the 1956 values obtained before drainage.

TABLE 1

SOIL SALINITY IN CURRUMBIN TRIALS

Year	Depth (in.)	1 % Cl	2 % Cl	3 % Cl	4 % Cl
1956	0–4	0·325	0·950	0·695	0·160
1960	0–4	0·145	0·127	0·088	0·067
	4–8	0·153	0·123	0·095	0·073

It will be seen that a marked drop in soil chloride values has been brought about by drainage.

Zinc Deficiency in Linseed

A replicated field trial to observe the effect of zinc sulphate sprays on linseed was set out in co-operation with Agriculture Branch officers at Mt. Tyson on the Darling Downs. Although some valuable data were obtained following analyses of plants and seed, the linseed did not develop observable deficiency symptoms on the trial site as expected.

However, an observational experiment on a piece of "linear gilgai" soil formation, also at Mt. Tyson, showed that the linseed benefited greatly from zinc sulphate spray treatment. The difference in growth of linseed between treated and untreated plots was remarkable and this stimulation resulted in higher yields of grain and in better quality of the expressed oil. The oil content of linseed from affected areas was increased from 35.8 to 38.2 per cent. by the application of zinc sulphate sprays, and oil from the treated area had a refractive index greater than 1.4785 at 25 deg. C. (the minimum value prescribed by the Australian Standard Specification), whereas that from the untreated portion of the field was below this value.

Tomato Nutrition Trial

Although statistical analysis of the results from this trial at Redlands Experiment Station (a joint one with Horticulture Branch) is not yet available, results indicate that sulphur applications gave a response equal to that obtained by 3 cwt. superphosphate per acre. Sulphur was applied at an equivalent rate to that supplied by the superphosphate in the form of gypsum.

Routine Analyses

Samples for analysis included 3,225 soils and 845 waters. Of the soils, 1,171 were in connection with experimental projects, the remainder being farmers' samples submitted for fertility checks or to discover reasons for the abnormal growth of crops on them.

As regards waters, a report on the analysis of each was made to the sender and recommendations given as to the suitability of the water for irrigation and/or stock. In addition to water samples submitted to the Section by farmers, the Agricultural Chemist reported on 1,505 water analyses carried out by the Government Chemical Laboratory, Department of Health and Home Affairs, and assessed their suitability for irrigation and/or stock.

Tobacco Work

Leaf samples were collected from every 100th bale arriving at the Brisbane selling floor and from other bales where some abnormality was thought to exist. The 600 samples so obtained were analysed for chlorine, total nitrogen, total alkaloids, nicotine and nor-nicotine.

It was apparent from the survey that leaf produced within one watershed varied considerably from that in a nearby watershed. Composition could also vary with distance along the stream. The chloride content was the best constituent of those studied to indicate this trend.

Leaf samples from fertilizer trials at Millaroo, Tinana Creek and Bundaberg were analysed for major inorganic constituents and several organic components such as nicotine and reducing substances. In general, the leaf composition reflected changes in fertilizer levels of nitrogen and potassium, while the phosphorus and sodium content of the leaf tended to remain constant.

A trial laid out at Millaroo to check different rates and methods of water application resulted in 528 soil samples and 70 leaf samples being tested for chlorides. There was no significant variation in soil chloride, but leaf from the top half of plants irrigated by furrows in alternate rows and the rain-grown treatment was significantly lower in chlorides than that from the plots watered by the normal furrow technique or by sprays.

Analysis of seedlings has shown that the tobacco plant can absorb bromine up to 1 per cent. of its total dry weight when the seedbeds are treated with methyl bromide for fumigation purposes prior to sowing. Further studies will be undertaken to check the effects of such bromine levels on the yield and quality of the mature crop.

A start has been made on a series of 60 leaf samples specially selected by officers of the Agriculture Branch from farms in the Burdekin district. Reducing substances have shown a wide variation—from 3 to 26 per cent. Leaf collected from a similar group of farms in 1959 also showed a wide variation in composition, the 'flat' leaf generally tending to be higher in chlorine, calcium and magnesium but lower in potassium and total nitrogen than 'normal' leaf.

Miscellaneous work included checks on the chloride content of leaf from new areas, residues on leaves from fungicide sprays, and analyses of soils and waters from growers desirous of developing new tobacco areas.

DIVISION OF ANIMAL INDUSTRY

Reference has been made to an important milestone in the annals of the stock side of the Department—the passing of the first 50 years since the establishment of the former Stock Experiment Station at Yeerongpilly, now known as the Animal Research Institute.

The Division can look back with pride on the very considerable achievements of those who have gone before at Yeerongpilly. To do so is particularly fitting on such an occasion. At the same time it heightens the resolve of present-day staff to emulate and if possible excel their predecessors. The staff today has a big advantage because of the much better facilities and techniques available. At the same time, it is but fair to claim that the problems still awaiting solution are on the whole the more complex and ill-defined ones. That is in the nature of things.

THE INFERTILITY PROBLEM

As an example of a complex and ill-defined problem one can instance infertility in cattle and sheep. The climate, disease, nutrition, management and even some anatomical considerations are all involved and seemingly inextricably mixed up together. It is small wonder, really, that despite a quite substantial effort for several years past the problem still awaits clear definition. This is not to say no progress has been made. Reference to the Sheep and Wool, Veterinary Services, Cattle Husbandry and Pathology Branch reports will quickly dispel any such notion.

The fact remains, however, that a large area of the problem remains somewhat blurred and must be brought into focus before final answers can be given.

Where dairy cattle and infertility due to disease are concerned, it is nevertheless becoming increasingly apparent that artificial insemination can go a long way towards providing a satisfactory answer. Recognising this, the Division is striving hard to provide an extensive artificial insemination service to the dairying industry as early as possible.

It is not generally appreciated just what is required in the way of facilities and staff, which automatically takes in considerations of finance, to establish and guarantee the smooth running of a large-scale artificial insemination centre. The Division has provided a limited service for several years now in connection with bull proving projects and inseminator training (see Husbandry Research and Cattle Husbandry Branch reports) and disease control (see Veterinary Services Branch report—sections on vibriosis and trichomoniasis), not to mention a co-operative artificial stock breeding association on the Atherton Tableland. This has been done for the most part in makeshift facilities and in the face of quite serious staff difficulties. The experience has been such as to underline the folly of attempting any expansion of activities in this field until a properly constructed centre with full facilities is a reality.

Progress with that end in view received a serious setback during the year through the loss of a site chosen for the Centre to the Brisbane Market Trust. The acquiring of the site had earlier taken quite some time. A new site had then to be found and acquired. This proved difficult but owing to the good offices of the Department of Health and Home Affairs a suitable area was eventually made available in the grounds of the Brisbane Mental Hospital at Goodna. These facts are recorded here simply to explain what might appear to some to have been inexplicable delays.

SUBSISTENCE FEEDING

For several years now work has been proceeding at the Rocklea Animal Husbandry Research Farm on what might well be called subsistence feeding of cattle. This was prompted by the knowledge of great losses of breeding stock in time of drought.

Much knowledge has been available for some time now on the drought feeding of sheep, but until the work referred to was put under way, little was known of the feeding of cattle in similar circumstances, at least under Australian conditions. Although it has so far failed to capture the imagination of the industry, the work stands revealed as of the first importance, the more so in view of the enhanced values for cattle and the urgent need to increase beef production.

Farmers and graziers naturally look for results from research that will be of value to them in the day-to-day running of their farms and stations. One result of the work at Rocklea is a new understanding of the role of protein-rich (or in the case of urea, nitrogen-rich) supplements when added to low quality roughages such as sorghum silage, and bush hay more so. Meatmeal, lucerne hay and urea, which are all supplements of the kind mentioned, have been shown to have the valuable indirect effect of increasing very substantially the intake of low quality roughage. There is thus a twofold effect, one from the nutritive content of the supplement itself and one from that of the additional roughage eaten.

The importance of this knowledge is self-evident and for further details reference should be made to the Husbandry Research Branch report. It, however, goes further than subsistence feeding, as the knowledge can and indeed already has been extended to supplementary feeding of growing stock, as will be ascertained by reference to the Cattle Husbandry Branch report.

Five technical papers on the Rocklea work have already been published (four in the *Queensland Journal of Agricultural Science* and one in the *Australian Veterinary Journal*), and another is in the press.

BEEF CATTLE RESEARCH

As mentioned in the Cattle Husbandry Branch report, a property in the Burdekin River basin was acquired by the Department during the year for development as a beef cattle research station. The Division of Animal Industry has accepted with enthusiasm the task of developing the property. It will not of course be an easy task and financial considerations seem certain to weigh heavily against rapid progress.

Research on the husbandry or production side of the beef cattle industry has lagged behind that accorded the sheep industry for a long time. The reasons for this may well be found in the fact that in other States where the centres of learning in the biological and applied sciences are of much longer standing, the beef cattle industry is of lesser importance than it is in Queensland. The increasing importance of beef production in the scheme of things has, however, brought a much needed change of attitude. It is obvious that all concerned, and not least the beef cattle producers themselves, are now seized with the necessity to step up the research effort in this field.

The Division has, of course, carried out research work in the beef cattle production area at the Rocklea Animal Husbandry Research Farm, at "Brian Pastures", (Gayndah), at Ayr Regional Experiment Station, and at the Bureau of Tropical Agriculture (South Johnstone), and its sub-station at Utchee Creek. However, prior to the acquisition of the property in the Burdekin basin it did not have one given over primarily to beef cattle husbandry research. The facilities at the centres mentioned are mainly for work on pasture establishment and maintenance with a view to fattening cattle, and do not lend themselves to investigation of the various aspects of breeding and management.

It is very satisfactory to be able to record at this time that the Division has a suitable property that it is proposed should be devoted specifically to research into beef cattle production. The Division is thus in a position to play a vital role in expanding research in this field.

DISEASE FRONT

On the disease front an emergency arose from the occurrence of infectious rhinitis of pigs in South Australia. An Order in Council dated December 23, 1959, was gazetted prohibiting the introduction of pigs from States in which the disease is known to exist. Queensland was still free from this disease at the year's end. Some inconvenience and frustration were caused while other States, Victoria in particular, surveyed their own position, but these are inevitable when disease control measures have to be taken at short notice.

The threat of bovine contagious pleuropneumonia (B.C.P.P.) took a new form due to movements of store cattle by sea from infected areas of the Northern Territory direct to the south-eastern portion of the State. As a frank counter measure a protected area was declared by Notice in the *Government Gazette* for the south-eastern area and entry of store cattle restricted to those that have been in Queensland for at least three months. This was done with considerable reluctance, as the trade would be quite valuable to most people concerned. The interests of those who purchase the cattle as well as of owners of cattle on adjoining properties must, however, be accepted as coming first. An additional consideration was that Queensland is committed to a progressive policy of eradication of B.C.P.P. and these movements by sea were outflanking our line of advance. Moreover, it should be stated that a protected area for south-eastern Queensland had been under consideration for some time prior to the movements in question.

Reference to the above two matters will be found in the report of the Veterinary Services Branch.

The situation respecting equine infectious anaemia (E.I.A.) was quite stable during the year. This, taken with events in other States, heightens the view that the disease may have been present in Australia for some considerable time past. Its mild nature (in most cases) under our conditions and sporadic occurrence are considered to have militated against an earlier diagnosis.

There remains the possibility of there being some confusion by reason of the now strongly suspected presence of another virus disease of horses analogous to, if not identical with, infectious rhinopneumonitis (influenza).

As far as is known, E.I.A. has never been eradicated from any country once an entry has been effected.

All transmission work so far done with E.I.A. at Yeerongpilly has perforce been carried out in a temporary facility. This must be attended by the risk of an "escape" and points to the urgent need for a permanent and properly constructed virus diseases investigation unit.

PIGS AND POULTRY

From the administrative standpoint the introduction of Regulations to control the selling of poultry was noteworthy. The Poultry Industry Acts were the ones concerned and so Poultry Branch staff has so far been used to see that the Regulations are observed. However, as the Division is in the process of building up a special Slaughtering Section it is likely this latter will ultimately take over control.

The introduction of a pullorum disease accreditation scheme for flock owners was also noteworthy. Pullorum testing as such has of course been in operation for many years but it was not until this year that facilities for accreditation were provided. They have been eagerly availed of by the industry.

The Pig Industry Inquiry Committee completed its report and made a series of recommendations to the Minister. These were designed to bring about a greater measure of stability in the industry. The main recommendation concerned the setting up of a Pig Industry Council, but as at the year's end it was plain that the processing side of the industry was not favourably disposed towards this.

The Pig Testing Station at Rocklea was firmly launched on its way. There were some unforeseen difficulties along the way arising from protein quality in the ration. These touched off an intensive study of methods of assessing protein quality in rations, some preliminary details of which are given in the Biochemical Branch report.

STAFF

On balance, the staff situation was relatively stable during the year but there are still a good many vacancies for graduates in the Division, particularly those with a veterinary qualification. Diplomates, too, have been in short supply. It is a matter for deep concern that those who seek positions in the Division are usually "well down the list."

At the Animal Research Institute, Yeerongpilly, the Pathology Branch is in a better position for staff than for many years past and the Biochemical Branch is in a sound position, but the Husbandry Research Branch is in urgent need of veterinary graduates. This need is made the more urgent by the commitment to extend the artificial insemination service afforded by the Division as soon as possible.

Graduates are wanted in the Veterinary Services, Cattle Husbandry, Sheep and Wool, and Pig and Poultry Branches. The important position of Director of the last-mentioned Branch remained vacant throughout the year.

The Department's scholarship system can be expected to gradually make up the leeway, though a small but continuous wastage of trained staff will cause delay.

VETERINARY SERVICES BRANCH

DISEASES OF CATTLE

Contagious Pleuropneumonia

A relatively large number of outbreaks of contagious pleuropneumonia were detected and dealt with during the year. Twenty-one quarantines were imposed and three lifted. A total of 18 remained in force at the end of the year. Of these nine were associated with active cases and nine were precautionary.

The majority of quarantines were associated with one mob of 1,100 head introduced to the Darling Downs following sea transport from Darwin. These cattle were inoculated under supervision in the Northern Territory and before C.P.P. was detected had been sold and depastured on 24 different properties. Affected cattle have been detected on only one of these holdings, but contacts have spread the disease to three other properties and a further 33 properties in the Toowoomba, Warwick and Goondiwindi areas are under surveillance because of suspected contacts. Where possible the disease is being controlled by test-and-slaughter or by a combination of test-and-slaughter followed by vaccination. Observations on these cases at meatworks have disclosed a number of carrier animals.

These outbreaks showed that inoculation prior to introduction could not be relied upon to prevent outbreaks in cattle introduced into clean areas by rapid means of transport and coming into contact with susceptible animals.

A protected area in respect of contagious pleuropneumonia, embracing all ports from Rockhampton south and extending as far west as Wandoan and Bonshaw, was declared. No cattle can enter this area unless they have been depastured in Queensland for the preceding three months. Other regulations ensure that all cattle from enzootic areas will have received inoculation prior to entry. Special exemptions cover the entry of slaughter cattle or those in transit to other areas, cattle from States free of the disease, and cattle negative to the complement fixation blood test.

The survey on lesions of C.P.P. detected at meatworks is being continued. A previous weakness of this survey was that no record was kept of drafts in which no disease was detected. Since the commencement of the current killing season details will be recorded of all mobs passing through export works, so that the actual percentage incidence of C.P.P. in all stock slaughtered from individual properties will be recorded.

The extension programme in respect of control in the field was continued throughout the cattle season.

Tuberculosis

One new district was brought under the provisions of the compulsory testing scheme. Due to lack of Approved Veterinary Surgeons the scheme was temporarily suspended in two areas, Mackay and Esk-Toogoolawah. Both areas have been under test for more than three years and the incidence of tuberculosis reduced to a low level.

The subsidised mileage system for veterinary attention in the Murgon district worked satisfactorily and it was possible to halve the producers' contribution.

A total of 331,037 tests was carried out under the compulsory scheme during the year and 362 reactors destroyed. Details are given in Table 1, and Table 2 shows testing by Departmental veterinary officers.

No lesions were found in 50 positive and suspicious reactors to the tuberculin test slaughtered in the Roma area. Comparative testing of animals derived from this herd, using P.P.D. tuberculin of avian and mammalian strains, indicated that the reactions were non-specific in nature. There was some indication that the short thermal test may be useful in doubtful cases but insufficient tests could be carried out.

Table 1

STOCK TESTED FOR TUBERCULOSIS, 1959-60

District	No. of Herds	No. of Tests	No. of Reactors	Percentage Reactors
Brisbane Division—				
Southport South	100	7,831	7	0·09
Coomera-Southport	115	10,888	1	0·01
Beenleigh-North	77	2,352	5	0·21
North Brisbane-Petrie	102	5,873	12	0·20
Moggill-Kenmore	25	947	..	..
Samford	24	1,198	..	..
Beenleigh-Beaudesert	163	10,696	7	0·07
Beaudesert-Border	98	12,153	87	0·72
Dayboro	55	3,863	3	0·08
Dayboro-Mount Mee	6	453	2	0·46
Woodford	78	7,009	17	0·02
Caboolture	9	757	1	0·13
South Ipswich	187	9,141	3	0·03
Chambers Flat	19	1,001	..	..
Maroochy Shire	170	10,091	1	0·001
North Ipswich	228	10,200	3	0·03
Boonah	182	8,537	8	0·09
Maleny-Landsborough	93	7,229	13	0·02
Esk	144	11,341	28	0·25
Laidley-Lowood	179	6,959	2	0·03
Brisbane Division Totals	2,045	128,198	200	0·15
Cairns Division	372	17,464	6	0·03
Townsville Division	..	738	13	1·7
Rockhampton Division	393	30,472	47	0·15
Maryborough Division	1,717	101,065	62	0·06
Toowoomba Division	1,078	53,100	34	0·06
Grand Totals	5,605	331,037	362	0·11

Table 2

HERDS TESTED BY GOVERNMENT VETERINARY OFFICERS

Division	No. of Herds	No. of Tests	No. of Reactors	Percentage Reactors
Townsville	16	4,564	98	2·15
Rockhampton	13	1,094	..	..
Toowoomba	28	567	..	..
Cairns	..	197	9	4·57
Brisbane	29	433	1	0·23
Roma	11	402	50	12·44
			(47 N.V.L.)	..
Maryborough	15	751	1	0·13
Totals	112	8,008	159	1·99

Of the 4,564 tests carried out by Government Veterinary Officers in the Townsville area, 3,895 relate to beef cattle. Of these, 1.21 per cent. were reactors.

Infertility

Brucellosis in cattle was again quite prevalent and some selected herds in which abortion storms were occurring received whole-herd vaccination. Most vaccination is restricted to heifers under eight months of age. The number of vaccinates is still unsatisfactory but an improving trend is noted. Pastoral conditions and high meat prices have a marked effect on the number of heifers retained in any particular year, causing marked fluctuation in the number of vaccinates. The vaccinations reported were—

Cairns Division	1,248
Toowoomba Division	15,718
Rockhampton Division	1,874
Roma Division	981
Maryborough Division	27,278
Brisbane Division	9,214
Total	56,313

The majority of vaccinations are performed by practitioners but Departmental officers accept this responsibility in isolated areas.

Vibriosis again figured as a major cause of bovine infertility. Limited mucus agglutination testing in beef herds with infertility problems also suggests that the

disease is widespread and of considerable importance in the beef cattle industry. In general, good results are obtained with antibiotic treatment and improved bull management.

The artificial insemination centre on the Atherton Tableland has diminished the effects of vibriosis in the area served by it.

After several years' freedom from trichomoniasis, this disease was again detected in both beef and dairy herds. Four beef herds are now known to be affected. Three of these were associated with one imported bull. One dairy herd in the Brisbane area was found to be infected after a disposal sale and extensive tracing of dispersed animals was undertaken. One herd became infected by purchases from this property. A previously infected herd in the same area again gave positive samples. It is not clear yet whether this represents a reinfection.

More than one thousand samples from herds scattered throughout the State with suspicious breeding histories have been examined with negative results, so it appears that the infection is uncommon in dairy cattle.

Eradication is being undertaken in all infected herds. Except under unusual circumstances, involving bulls of great value, a programme of slaughter of all infected bulls, three months' sexual rest of females and controlled breeding has been adopted. Two officers have been specially trained in artificial insemination in order to supply an A.I. service to infected herds.

Treatment of valuable bulls under the supervision of Departmental officers has been undertaken. Such animals must be successfully test-mated to a number of virgin heifers at least three months after treatment before being used in the herd. The results of treatment have been erratic, one bull relapsing and giving positive trichomonad cultures some 2½ months after treatment.

Leptospirosis

Acute cases of leptospirosis continue to occur. A vaccine against *Leptospira pomona* is available and is used fairly extensively on the Darling Downs. However, the short period of protection and the sporadic nature of the losses limit its use. Heavy mortality in calves occurred in the Toowoomba area.

Abortions in adult cattle and pigs are relatively common. On field evidence there are ample grounds to incriminate *L. hyos* as a cause of abortion. In many herds titres to both *L. pomona* and *L. hyos* occur. In the Rockhampton area 15 stud Herefords in a group of 30 aborted within a fortnight. All aborted cows gave high titres to *L. pomona* whereas cattle in neighbouring paddocks with no history of abortion gave negative titres.

Severe outbreaks occurred in calves at Barcaldine but it was not noted in adult cattle. Infection appears to be associated with grazing the green pick along drains and bore channels.

Mastitis

Considerable difficulty is still being experienced with the treatment of staphylococcal mastitis, and a variety of antibiotics, combined with improved hygiene, machine management and husbandry, are advocated. No one antibiotic has been consistently successful.

Klebsiella species have previously been isolated from the udders of cows with severe mastitis. In one herd at Atherton, 19 out of 24 milkers were affected with a highly infectious disease with systemic symptoms accompanied by acute mastitis. *Klebsiella* were isolated in pure culture from milk samples and from liver and heart at autopsy. Two animals died, showing a pericarditis and heart lesions, 15 returned to more or less normal production and two remained chronically affected. Although the infection spread rapidly through the milkers it has not spread to the dry cattle or to neighbouring farms.

A number of cows at Mundubbera showed a persistent mastitis from which *Nocardia* were isolated. The source of the infection has not been traced.

Tick Fever

Losses in premunised cattle were reported in a number of districts. In some cases bad husbandry coupled with heavy tick infestation has been blamed as the precipitating cause.

Field observations are being made on three "bleeders" inoculated with a recently isolated field strain of *Babesia argentina*. This strain is tick-transmitted and it is hoped that it will confer a greater degree of immunity in marginal country. In spite of an initial mortality of some 4 per cent. in susceptible inoculates, the strain appears to be standing up well at present under current field conditions.

Anaplasmosis still occurs sporadically in most Divisions.

Winter Dysentery

There were field reports from the Toowoomba District as to the occurrence of this disease, but it would appear likely that the rest of the State is completely free.

A widespread condition in dairy cattle grazing oats in the spring was, however, reported. Cases were characterised by cessation of lactation, muscular stiffness and some diarrhoea. Fever was absent and most animals recovered fully in 7-10 days.

Blackleg

Following the confirmation of blackleg in allegedly vaccinated calves, a survey was made for possible vaccination breakdowns. As most blackleg vaccination is carried out by stock-owners it is always difficult in any specific case to be sure that the dead calf was actually vaccinated properly. However, several confirmed blackleg cases occurred in animals vaccinated more than once by veterinary practitioners. Although any such failure is rather disturbing, it is clear that there has been no wholesale breakdown of vaccination.

St. George Disease

Cases of St. George disease occurred on eaten-out, heavy blacksoil river flat country. This occurrence is similar to the so-called Angle Island disease of Rockhampton.

A very similar disease was reported from Winton, Jericho and Yalleroi. Oedema of the throat and brisket was extremely marked but in addition there was lachrymation and photophobia. Blood protein content was variable, ranging from normal to low.

Ephemeral Fever

Sporadic cases of ephemeral fever are occasionally reported but the identity is doubtful except in the Charters Towers–Townsville area, where it appears to occur frequently, with low morbidity and mortality. Such cases are, however, seldom seen by Departmental officers.

Neonatal Mortality in Calves

This trouble appeared on a very reduced scale in the South Burnett and did not occur in the Toowoomba Division.

Sawfly Poisoning

Moderate losses from sawfly poisoning were reported from the Upper Warrego and Augathella. Heavy losses were reported on several Springsure properties in 1959.

Non-purulent Encephalomyelitis

A paralysis of calves was again reported from a small number of herds at Ipswich, Nambour and Kilcoy. Most cases show posterior paralysis but in one case the forequarters only were affected. Morbidity is low (two or three cases per herd) but the mortality is about 75 per cent. Spontaneous recovery occurs in some cases. The pathological lesions are typical of non-purulent encephalomyelitis and the presence of a virus of low virulence is postulated.

DISEASES OF SHEEP

Infertility

Epipidymitis in rams is detected by clinical examination, microscopic examination of semen smears and blood testing. A scheme embracing all three methods for the eradication of the disease, with particular reference to the British breeds of sheep, is being worked out.

Evidence of toxoplasmosis in one Dorset Horn flock was obtained following continued investigation into low lambing percentages. It is hoped to correlate blood titres with the isolation of the organism. Work is proceeding in co-operation with University staff.

Positive titres for *Vibrio fetus* were detected in infertility investigations at Dalby and Warwick but the significance of these findings is not yet understood

Muscular Dystrophy of Lambs

A condition affecting Merino lambs on a property in the Goondiwindi area has been under investigation for several years. Affected lambs fail to thrive and show altered gait, ruminal tympany and distress and prostration on exercise. Lesions suggestive of "white muscle disease" have been detected in certain skeletal muscles but such lesions have not been found constantly. A limited trial with selenium, vitamin E and a combination of both produced results which suggest that further work along these lines should be attempted. The dams of affected lambs were identified and will be kept under observation following the 1960 lambing.

Actinobacillosis

An actinobacillus was isolated from testicular lesions in rams in two flocks in the Toowoomba Division. Lesions associated with this infection are acute orchitis accompanied by transient systemic illness and lameness.

Melioidosis

This was identified in sheep, cattle and pigs on slaughter in North Queensland but no fresh field outbreaks were detected.

DISEASES OF PIGS

Brucellosis

One stud herd showed a very high percentage of infected animals. Quarantine was applied and the infection is being eliminated by test-and-slaughter. Two heavily infected commercial herds were detected in the Cairns area. Both herds had introduced pigs from a great number of properties. In general, the rate of infection in Queensland pigs is very low.

Infectious Rhinitis

Following the identification of infectious rhinitis in swine in South Australia, measures were taken to prevent the introduction of infected pigs into this State. The introduction of these measures coincided with the illegal introduction of a number of Landrace pigs, which were quarantined pending investigation.

Several outbreaks of "snuffles" in pigs were investigated clinically and pathologically but no findings indicative of infectious rhinitis were obtained.

Miscellaneous

Pneumonia remains the most serious disease of pigs and occurs in all districts. Several pig-raisers, particularly in the Toowoomba area, are attempting to establish piggeries free from virus pneumonia and in this are assisted by local officers.

Erysipelas associated with sudden deaths was reported fairly frequently but this disease does not seem as common as it was several years ago.

Sparganosis in feral pigs or domestic pigs maintained under range conditions caused factory condemnations.

Glasser's disease, salmonellosis and sarcoptic mange were relatively common.

Klebsiella spp. were isolated from three pigs affected with metritis and also from septicaemias and pneumonias of pigs.

DISEASES OF HORSES

Equine Infectious Anaemia

Further field and survey work on equine infectious anaemia was carried out, including an intensive examination of properties in the Mackenzie River area, where the disease was first confirmed.

Horses losses from the disease during the year were light and it would appear that it is of economic importance only on a few properties, and that even on these losses can be expected to fluctuate widely from year to year. Six properties are now known to be infected but there is field evidence that cases may occur on other properties. The scattered location of the infected properties is consistent with the suggestion that the disease has been present in Queensland for some years and no common source of infection has been traced.

The siderocyte test for the detection of infected horses has not proved of much value for the detection of field cases. The lack of pathognomonic clinical symptoms and the security precautions necessary to carry out blood transmission tests in a non-infected area have proved great handicaps in surveying the infected area.

The failure of the normal monsoon rains and subsequent flooding of the main infected area may have been responsible for the small number of cases reported during 1959-60.

Miscellaneous

Cases of Birdsville disease were reported from Windorah but otherwise losses were light.

Strangles was prevalent in the Goondiwindi area.

DISEASES OF POULTRY

Pullorum

Following an outbreak of pullorum disease in chickens in Cairns the source of infection was traced to a hatchery in the Maryborough Division. Infection on this hatchery had been kept well below 1 per cent. by regular blood-testing but it is thought that faulty incubator management and disinfection allowed a build-up of infection. This has been now reduced to less than 0.2 per cent. by testing, disinfection, slaughter and replacement with clean stock.

Infectious Laryngo-tracheitis

Incidence of I.L.T. was low in the Toowoomba Division. Approximately 180,000 birds were vaccinated, mainly in the Brisbane, Townsville and Cairns areas. The majority of vaccinations are by the feather follicle method and mixed vaccine is used.

Miscellaneous

Nutritional disorders reported were mainly vitamin A deficiency, riboflavine and pantothenic acid deficiency, crazy chick disease, rickets, perosis and gizzard erosion.

Streptococcal septicaemia occurred in ducklings. Epidemic tremor was much less frequent than in 1958.

Heavy losses of brooder chicks followed ingestion of a mash containing 21,850 p.p.m. manganese. Post-mortem lesions included gastrointestinal erosions. Affected chicks scoured and were excessively thirsty.

POISONING

Arsenic

Heavy losses again occurred (mainly in cattle) from arsenical poisoning. Sources of poison included sprayed banana plants, weedkiller sprays and contaminated salt lick. Almost a complete herd was wiped out near Rockhampton following weed spraying. Calcium versenate treatment in this case was not successful. Dips and tickicide sprays are becoming increasingly less important as a cause of arsenical poisoning.

Two serious mortalities followed dipping of sheep in arsenical compounds and one followed use of a proprietary arsenical drench.

One hundred-and-twenty sheep were lost following licking of arsenical containers discarded in a rubbish dump in a holding paddock.

Organic Tickicides

These substances, DDT excepted, were again responsible for some deaths. Most serious cases of chlorinated hydrocarbon toxicity followed dipping in freshly charged vats. It is thought that an abnormal quantity of insecticide is taken out on cattle in the first dipping, leading to toxic absorption. This is supported by the fact that analysis of dips following such mortalities is usually considerably lower than would be expected and subsequent dippings are uneventful.

There were isolated reports of toxicity of organic phosporus compounds but no large numbers were involved. In one case symptoms of photosensitisation were marked. A few horticulturalists and tobacco farmers persisted in using endrin for tick control and deaths frequently followed use of this spray. It was also responsible for the death of a number of fowls at Mareeba.

A heavy mortality in fowls followed the use of a spray containing lindane, aldrin, BHC and DDT.

Miscellaneous Chemicals

Phosphorus as poison baits was responsible for the death of three cows. Lead poisoning was confirmed in cows and calves.

Salt poisoning of cattle occurred in the Burnett and Cairns districts. In two cases the source was licks made available to salt-hungry cattle. Losses from salt poisoning also occurred in pigs near Biloela. Dieseline and kerosene also caused isolated deaths.

Copper poisoning in rams occurred during drenching for deficiency.

Plants

Severe losses occurred in several travelling mobs of cattle from ingestion of Ellangowan poison bush (*Myoporum deserti*).

Noogoora burr (*Xanthium pungens*) caused losses in cattle and pigs in all coastal districts.

Asthma plant (*Euphorbia hirta*) was blamed for the death of ducklings.

Prussic acid poisoning was not particularly common but a heavy mortality occurred at Inglewood. *Sorghum almum* caused losses at Hughenden.

Wild tobacco (*Solanum auriculatum*) is strongly suspected of causing extensive mortalities on the Atherton Tableland. Losses of up to 30 cows in six months on one property were experienced and portions of the plant were consistently recovered from the ingesta.

Yellow-wood (*Terminalia oblongata*) losses were lighter, probably due to the mild winter. Because of the lack of frost, complete defoliation of the trees and rapid deterioration of pasture was not evident. Considerable interest is being shown in the main yellow-wood areas in controlling losses by clearing the trees and establishing pasture. No detailed recommendations can yet be made.

Malva parviflora was responsible for pig mortalities at Oakey and Killarney and hemlock (*Conium maculatum*) for cattle losses at Killarney.

Other plants incriminated as toxic to stock during the year included—

Euphorbia drummondii (caustic weed)—sheep.
Melia dubia (white cedar)—pigs.
Bulbine semibaccata (onion weed)—sheep.
Salvia reflexa (mintweed)—cattle and sheep.
Lantana camara (lantana)—cattle.
Duboisia myoporoides (corkwood)—cattle.
Cestrum parqui (cestrum)—cattle.
Trema aspera (poison peach)—cattle.
Thredkeldia proceriflora (soda bush)—sheep.
Gastrolobium grandiflorum (heart-leaf)—cattle.
Erythrophloem chlorostachys (Cooktown ironwood)—cattle.
Crotalaria retusa (rattlepod)—horses.
C. dissitiflora—horses (suspect).
Schinus molle (pepperina)—pigs.
Pteridium aquilinum (bracken).
Salvia coccinea (salvia)—cattle.
Verbesina encelioides (wild sunflower)—cattle.

EXTERNAL PARASITES

Cattle Tick

Further outbreaks of cattle ticks were reported from the Darling Downs during the year. The majority of the properties involved were situated close to the Dividing Range. However, isolated outbreaks occurred near Warwick, Felton, Greenmount, Biddeston, Meringandan, Oakey, Jimbour and Canaga. Ticks reached saleyards at Oakey and Toowoomba, resulting in restrictions being placed on the movement of stock to clean areas. Dips charged with DDT are now in use at saleyards at Quinalow and Oakey. It is suspected that in some cases illegal movements and substitution of cattle were the cause of these outbreaks but there is some evidence that at times ticks may have been spread by movements authorised following spraying in lieu of dipping. Steps have been taken to institute an identification system in cases where substitution is suspected.

Removal of quarantine restrictions was effected on a number of properties and further releases are anticipated later in the winter.

Minor extensions of infestation occurred in the Upper Warrego. Tick infestation in the marginal areas of Alpha and Jericho has been considerably reduced and many properties are now clean. This involves increasing difficulties in moving stock through the area.

Control measures in the South Burnett have been applied successfully and most infected properties are due for release. Only a small number of reinfestations were reported. The only new active centre is the Kunioon area, where fresh infestations were detected. The poor state of fencing in this area has greatly hampered efforts to contain the parasite.

With the charging of the Iredale dip most marginal areas below the Toowoomba Range have adequate dipping facilities and dipping before clearing for non-infested marginal country is insisted upon. The voluntary cleansing programme in the Coalbank area is progressing satisfactorily. The completion of eradication in areas of New South Wales contiguous to Stanthorpe led to a relaxation of dipping requirements for stock crossing into Queensland and it is expected that these will be completely lifted in this area.

Field trials with organic phosphorus dips are continuing and a trial on a carbamate derivative is in hand at Cairns.

Frothing has been a problem in spray dips charged with some DDT formulations. An additive based on kerosene and a silicone anti-foam has reduced frothing to manageable proportions.

Increasing resistance is diminishing the use of chlorinated hydrocarbon tickicides. Although DDT resistance has been reported from some areas and demonstrated under experimental conditions, it is not important provided the dips are maintained at full strength and stirred effectively prior to use.

Buffalo Fly

This parasite was relatively quiescent until March, when it was reported at Fairymead, north of Bundaberg, but it did not extend further south. About the same time it appeared at Injune and Roma and a little later at Miles. Rail spraying was instituted at Miles and retained at Rosedale. The increasing use of residual insecticides against ticks is having a marked effect on the control of buffalo fly. The onset of cold weather limited the spread of this parasite and caused its retreat northwards.

Lice

Infestations were generally light in sheep but some heavy infestations in cattle were noted on the Western Downs in spring.

Sheep Blowfly

Increased resistance to chlorinated hydrocarbons has been noted and many properties have changed to organic phosphorus compounds. Fly was active during the early summer but did not reach the serious proportions of last year.

Itch Mite

Considerable interest has been shown in the incidence of itch mite owing to the failure of chlorinated hydrocarbon dips to control this parasite. However, it does not appear to have any economic importance in Queensland except in the Warwick district. While a positive diagnosis presents no difficulties, negative findings, unless repeated, have little significance. However, there is evidence of a considerable amount of non-specific itch in sheep.

Nasal Bot

This parasite seems rather more prevalent in Queensland than some years ago.

Stickfast Flea

This parasite is now widely distributed in the State, but each infestation appears to be isolated from other outbreaks. It is now firmly established at Barcaldine and Blackall, as well as Chinchilla and Jandowae. Isolated infections were reported from Goondiwindi, Warwick, Tara, Toowoomba, Oakey, Charleville, and the Brisbane district.

INTERNAL PARASITES

The relatively dry season diminished infestations of internal nematodes. However, serious infestations in beef cattle to two years old were noted near Rockhampton.

Considerable interest is being shown in the use of organic phosphorus compounds to control *Haemonchus* and also in the new treatments for lungworms.

EXTENSION

A second graziers' school was held at Magnetic Island in conjunction with Agriculture and Cattle Husbandry Branches and a series of 2-day schools for dairy farmers (also in conjunction with other Branches) was instituted on the Atherton Tableland.

In addition, the Branch participated in a Rural Science School at Roma with speakers from other Branches, the University and the Education Department; also in field days with representatives of commercial firms.

It is felt that considerable benefit can be obtained from such activities where all aspects of broad fields of primary production can be discussed by experts on a basis of farmer participation. To obtain the maximum benefit it is felt that these schools should "live in". This is relatively easily done with graziers but it, of course, difficult to achieve with dairy farmers.

Branch releases to local and State-wide newspapers are well catered for. Many centres now provide a regular article of local interest to the local newspaper. Releases are also prepared for local broadcasting stations.

The Branch ran its first induction school for newly appointed officers. In addition to discussing disease control problems, time was allocated to extension training and administration. Fifteen newly appointed officers attended.

Ten officers were admitted to the Extension School at Alexandra Headlands for more experienced officers.

STOCK MOVEMENTS

Interstate stock movements are set out in Table 3.

SLAUGHTERING

The Slaughtering Section was greatly strengthened by the appointment of a Divisional Veterinary Officer (Slaughtering) to the Head Office staff. This position had been vacant for some time, and the filling of it will allow expansion of slaughtering activities. A Clerk-Inspector (Slaughtering) was also appointed as well as a small clerical staff for slaughtering duties.

The Branch took a much greater interest in the activities of District Abattoirs. A considerable improvement in liaison between District Abattoir Boards and the Department was brought about by the appointment of Senior Veterinary Officers to each of the Boards operating. These officers have been able to render much necessary advice to the Boards on technical problems that have arisen.

District Abattoirs are functioning at Toowoomba, Townsville, Ipswich and Bundaberg. Boards have also been formed at Mackay and Rockhampton to consider provision of Abattoirs. Several other centres are considering the formation of District Abattoir areas and Boards.

The year was generally a difficult one for the successful operation of District Abattoirs. Such abattoirs depend entirely on returns from slaughtering charges and sales of by-products to enable them to meet their constructional cost loan repayment commitments. The market for by-products, particularly oils, fell considerably during the year; consequently it was necessary to increase killing charges to some extent at certain abattoirs to maintain their economy of operation. Several District Abattoirs have been able to kill for interstate and export markets, but others are so situated that they cannot be utilised for this purpose. However, it should not be lost sight of that District Abattoirs are provided, principally, to meet the needs of the district population.

Restrictions on the introduction of meat into the Brisbane area were brought into being during the year. Regulations to provide for inspection of interstate-killed meats introduced into the Abattoir area were also enforced. The necessity for re-inspection of introduced meats was fully justified by the number of disease conditions as well as faultily dressed and contaminated carcasses found.

A system of classification and voluntary grading of carcasses has been carried out at the Cannon Hill Abattoir. All beef carcasses are classified as ox, heifer, cow or yearling and marked accordingly. The use of a ribbon brand for identification of yearling carcasses has proved to be very popular. Similarly a ribbon branding service with the word "Prime" is available to any operator who voluntarily desires to subject carcasses to prime grading. The prime grade qualification is necessarily of high standard and takes into account youth as well as a high degree of conformation and even, but not excessive, fat covering. Similarly all lamb carcasses are marked with the ribbon brand "Lamb".

The object of such marking is to allow the consumer to recognise that meat so marked is considered to have both youth and quality on its side and should necessarily provide for a better quality product at the price paid. This service is also available for extension to District Abattoirs. It is hoped that as the housewives and consumers become more aware of the better quality of meats so identified they will demand it of their butchers, who in turn will seek the service of the Department to classify carcasses accordingly.

An important task of the Slaughtering Section is to obtain data from meatworks relating to the disease conditions found at slaughter. This is of major importance in relating back to the field the incidence and distribution of certain diseases such as contagious bovine pleuropneumonia and tuberculosis. Meatworks surveys have helped considerably to provide much useful information to control the incidence and spread of these diseases and others. Unfortunately, this Branch has not sufficient staff to maintain officers at all export works

to collect the required data. Consequently it is appreciated that the co-operation of officers of the Commonwealth Department of Primary Industry has been forthcoming.

Just as many changes have occurred in the slaughtering side, many changes have occurred in the retail handling of meats, as well as the manufacture into smallgoods, etc. This has been really noticeable in the improvements to butcher shops, which are continually in progress and which are generally being voluntarily undertaken without necessity for instructions from inspectors. It would appear that the retail meat trade is becoming increasingly competitive and the retail purchaser is becoming more fastidious in choosing a butcher shop which contains a liberal amount of such materials as stainless steel, plate glass, tiles, laminated plastic covers and refrigerated display windows and counters. It has thus become increasingly evident that the public are recognising all the advantages of improved practices in relation to hygiene of handling meats.

The general co-operation of the trade is reflected in the small number of prosecutions of persons who are associated with slaughtering or sale of meat as their livelihood.

Table 3

INTERSTATE STOCK MOVEMENTS, 1959-60

——	Cattle	Sheep	Swine	Others
Entered from Northern Territory	54,143	..	..	..
Entered from New South Wales	40,432	724,089	1,680	2,002
Removed to Northern Territory	290	..	..	..
Removed to New South Wales	267,102	319,964	82,668	5,417

Of the 54,143 cattle which entered Queensland from the Northern Territory 4,088 head were introduced by road transport. In addition to this number, a further 5,832 head were moved between Camooweal and Mount Isa by road transport during the twelve months.

BRANDS

Details of registrations, transfers, etc., for the year 1959-60 are as follows:—

Item	No.	Number since Inception of Legislation
Ordinary three-piece horse and cattle brands registered	..	92,242
Cancelled horse and cattle brands re-allotted	878	20,907
Horse and cattle symbol brands registered	181	3,677
Horse and cattle brands transferred	1,695	92,175
Cattle earmarks registered	722	40,231
Sheep brands and earmarks registered	168	16,115
Sheep brands and earmarks transferred	259	11,100
Distinctive brands registered	8	1,368
Alterations of address	305	..
Brands cancelled	32	..
Earmarks cancelled	158	..

There was an increase in the number of registrations of horse and cattle brands, symbol brands and cattle earmarks and transfers of horse and cattle brands and sheep brands and earmarks, and a decrease in the number of registrations of sheep brands and earmarks.

Very few cases of irregular branding and earmarking were reported.

Revised copies of the Horse and Cattle Brands Directory, complete to the end of 1957, and the Sheep Brands and Earmark Directory complete to the end of 1958, were placed in the hands of the Printer in May 1959 and June 1959 respectively, but to date no work has been performed on either directory.

BREACHES OF ACTS

Nineteen persons were successfully prosecuted for breaches of the Stock Acts. Many of these breaches involved the use of motor transport. This form of transport is regarded as constituting a means of rapid dissemination of animal disease.

Nine successful actions were taken against persons under the Slaughtering Act.

Three owners were proceeded against successfully for breaches of the Brands Acts.

PATHOLOGY BRANCH

Improvement of facilities for Branch work within the laboratory and outside has continued both at the Animal Research Institute and at the Animal Health Station at Oonoonba. Active steps are being taken to provide adequate and up-to-date isolation facilities for investigation of the more infectious and dangerous diseases. The Oonoonba isolation block will be erected first because of the strong possibility that exotic diseases may enter from the north, and also because the smaller unit envisaged for that Station will provide a pattern for the larger one at Yeerongpilly.

DIAGNOSTIC WORK

The following figures give an indication of the diagnostic work done during the year. The bacteriology section made 1,613 examinations for organisms, using 15,500 petri dishes and 30,500 other media for culturing and identification of organisms; the histo-pathology section—whose work mainly embraces the microscopic study of tissues to classify tumours, types of pneumonia, nephritis, &c., and the more detailed examination of disease changes in general—processed 3,468 tissue specimens, cutting 8,455 sections for microscopic examination during the year. Examination of blood is becoming more important and a separate section is being developed for its study. In addition to the tick fever smears, nearly 5,000 haematological examinations were made during the year, and the serology section, as shown in Table 1, carried out 32,005 serological tests.

The total of 5,719 batches of specimens received for examination constituted a record. It is pleasing to report an increase in the number being received at Oonoonba.

Some of the more interesting and important diseases dealt with are set out below.

Cattle

Nervous Disorders.—Fifteen calves showing symptoms indicative of involvement of the nervous system were received for examination. Encephalitis or encephalomyelitis was diagnosed in 10, cerebellar hypoplasia in three and hydrocephalus internus and cerebellar haematoma each in one. Attempts were made to demonstrate the presence of an infective agent in brain material from five of the calves with encephalitis, by means of transmission tests to normal calves, but without success.

Mastitis.—In previous reports the prevalence of staphylococci in mastitis milks has been noted and attention drawn to other organisms as causes of mastitis. Unusual organisms were again recovered from milk samples submitted for examination. *Nocardia* sp. was isolated from one sample. Mastitis due to this organism is rare and there are only one or two records of it in the literature. *Pseudomonas* sp. was found to be the cause of a severe outbreak of mastitis causing the death of three cows. *Pasteurella septica* was also isolated from milk samples in this herd.

The number of isolations of the various organisms is set out below:—

Staphylococcus aureus	295
Streptococcus agalactiae	33
Streptococcus uberis	10
Streptococcus bovis	1
Streptococcus dysgalactiae	1

Corynebacterium pyogenes	3
Corynebacterium sp.	4
Pseudomonas sp.	16
Klebsiella pneumoniae	6
Pasteurella septica	3
Nocardia sp.	1

Salmonellosis.—Salmonellosis was diagnosed on 15 occasions. Fifty-four cattle were reported to have died and 36 others were sick in these outbreaks, which occurred mainly from June to September.

Trichomoniasis.—Trichomoniasis was diagnosed in four dairy herds during the year. This brings the total number of known infected properties in Queensland to six.

Abortion.—Fifteen foetuses or specimens from foetuses were examined. From these *Brucella abortus* was isolated on three occasions, *Vibrio fetus* on two, *C. pyogenes* on two, *T. foetus* on one and *Mycobacterium tuberculosis* on one. This is the first record of recovery of *T. foetus* from foetal material in Australia. The submission of aborted foetuses for examination is being encouraged.

Pneumonia.—Specimens from 26 cases of pneumonia were submitted. In 15 of these, contagious pleuropneumonia was suspected in the field but only eight were confirmed as such in the laboratory. The other 11 specimens were from calf pneumonias.

TABLE 1

SEROLOGICAL TESTS

—	Yeerongpilly	Oonoonba	Total
Complement fixation tests—			
Contagious pleuropneumonia—cattle ..	1,888	329	2,217
Johne's disease—cattle ..	12	..	12
Q Fever—cattle ..	5	..	5
goats	3	..	3
Brucellosis—sheep ..	2,818	..	2,818
Melioidosis—sheep ..	1	1,697	1,698
goats ..	..	123	123
Actinobacillosis—sheep	1,645	..	1,645
E.A.E.—sheep	6	..	6
Serum agglutination tests—			
Brucellosis—cattle ..	4,587	585	5,172
pigs ..	2,785	245	3,030
goats ..	5	..	5
L. pomona—cattle ..	3,556	456	4,012
pigs ..	1,245	275	1,520
horses ..	1	..	1
goats ..	2	..	2
sheep ..	11	..	11
L. hyos—cattle	3,556	414	3,970
pigs	1,245	233	1,478
horses	1	..	1
goats	2	..	2
sheep	11	..	11
Erysipelas—pigs ..	165	..	165
Salmonella pullorum—chickens ..	2	..	2
Mucus agglutination tests—			
Vibriosis—cattle ..	3,316	573	3,889
Hæmagglutination tests—			
Melioidosis—cattle ..	..	1	1
sheep ..	..	80	80
goats ..	..	126	126
Total	26,868	5,137	32,005

Blackleg.—An unusual form of blackleg was diagnosed in two calves on a property at Maleny. In both animals the psoas muscles only were affected. The calves had been vaccinated against blackleg six months previously after an outbreak had occurred.

Tick Fever.—*Babesia argentina* infection was confirmed in 60 field outbreaks, *Anaplasma marginale* in two and *Babesia bigemina* in one.

Poisoning.—Arsenic was responsible for poisoning on 29 occasions, with 99 deaths and 53 sick animals recorded. Lead poisoning was confirmed on 10 occasions, phosphorus on one and BHC on one.

The following plants were incriminated in deaths of cattle:—

Pteridium aquilinum (bracken fern)
Asclepias fruticosa (white cotton bush)
Gastrolobium grandiflorum (heartleaf poison bush)
Sorghum sp.
Sorghum almum
Verbesina encelioides (wild sunflower)
Xanthium pungens (Noogoora burr)
Solanum torvum (devil's fig).

Sheep

Brucellosis.—A complement fixation test has been developed for ovine brucellosis, using a soluble antigen prepared from *Brucella ovis* cells. This test is now offered as a routine method for samples submitted by field officers. Samples were received from 38 properties and positive results were found in 17 of these.

Muscle Disease.—Gross muscle lesions distinct from those of white muscle disease were seen in a sheep from the Texas district. The field report described a humpy-back syndrome. Microscopic examination showed considerable degeneration of muscle fibres. Two sheep subsequently submitted appeared to have recovered.

Miscellaneous.—A number of pathogenic organisms were isolated from sheep specimens during the year. These included *Corynebacterium ovis, C. pyogenes, Staph. aureus, Salmonella* sp., *Pasteurella septica, P. haemolytica, Br. ovis and Actinobacillus seminis.*

Examination of abscesses in slaughter sheep at Townsville showed that in a total of 772 animals, seven had melioidosis and 133 had *C. ovis* infection; *Streptococcus* sp. was recovered from two. There were also lesions due to *Oesophagostomum columbianum* (nodule worm), some tapeworms and liver fluke (*Fasciola hepatica*). This is the first record of fluke infestation in the Winton district, from where it is understood the sheep originated.

Five cases of *Psorergates ovis* from the Goondiwindi and Warwick areas were confirmed and *Trombicula sarcina* was identified from Roma.

Pigs

Of the infectious diseases recorded, salmonellosis was the most common, 16 outbreaks being confirmed in the laboratory.

Erysipelas was diagnosed on five properties, the septicaemic, cardiac, arthritic and skin forms all being recorded.

Specimens from 20 outbreaks of locomotory trouble were examined. In 12 of these the following conditions were detected—non-purulent encephalitis, non-purulent lepto-meningitis, purulent meningo-encephalitis, balloon degeneration of the spinal cord, polyarthritis and avitaminosis A. In the remainder, the cause could not be determined.

Blindness due to a non-purulent encephalitis was diagnosed in a piglet from an experiment station where 50 per cent. of pigs were showing complete or partial blindness.

Two rather rare conditions were diagnosed for the first time at the laboratory. Oedema disease, which has been recorded in a number of overseas countries, was found in pigs from a south coast piggery after it was re-stocked with pigs from a Brisbane saleyard. Terminal ileitis was seen on two occasions, in porker age pigs. They showed diffuse fibrinous peritonitis with perforations of the ileum near the ileo-caecal valve. The ileum was thick-walled and pipe-like for a length of about 18 in.

Faulty drenching of young pigs for worms, whereby the nozzle of the drenching gun perforated the pharyngeal region, caused heavy mortality in one piggery. All 27 pigs developed throat swellings, and 15 deaths occurred from a few hours to several weeks afterwards.

A number of other diseases was diagnosed, including septicaemia due to *Pseudomonas* sp., swine pox, viral pneumonia and poisoning due to white cedar (*Melia azedarach*).

Poultry

A total of 1,241 autopsies was made. In the 949 birds received from the field, coccidiosis was the most prevalent disease. This was followed by leucosis, nephritis and the respiratory disease complex in that order.

The changing pattern in the industry is reflected in the disease situation. Very severe intestinal and caecal coccidiosis was seen in laying pullets just when production should have been approaching a peak. There is a need for reorientation of ideas on chemotherapy for these diseases.

All dead birds from the random sample trials at the Rocklea Animal Husbandry Research Farm are autopsied at the Institute, and they provide an excellent opportunity to assess the occurrence of disease in birds from a number of commercial flocks kept under uniform conditions. Leucosis has accounted for approximately one-third of total losses from hatching to completion of two trials. Egg peritonitis and nephritis are next in importance.

The Poultry Adviser at Townsville submitted chickens from Ingham with red globular worms in the proventriculus. The parasites on morphological grounds belong to the genus *Tetrameres,* but judging by the size of the females (1.6–3.0 mm. long and 0.6 to 1.8 mm. wide) they appear to be different from those usually encountered in fowls.

A protozoan parasite, probably a *Haemoproteus,* was found in red blood cells of a wild black duck (*Anas superciliosa*) submitted from Pentland. The duck was jaundiced; the liver was light-brown and contained a large amount of blood pigmment.

RESEARCH

Tick Fevers of Cattle

Work in this field is gaining momentum, but is somewhat hampered by the need to divert attention from research work to routine immunisation of stud animals.

The three-pronged attack on these diseases has been continued. Studies of natural history of infection have been continued at Yeerongpilly with both *Babesia argentina* and *B. bigemina,* the results generally confirming those previously reported. At Oonoonba, studies of the transmission of immunity from cow to offspring were expanded, and evaluation of vaccine work progressed at Yeerongpilly. It is hoped during the coming year to introduce a fourth facet, viz. a study of serological changes in immunised cattle.

Natural History of Infection.—Infection of *Boophilus microplus* with *Babesia argentina* apparently only takes place when ticks are in the adult stage during the febrile period of tick fever and/or when parasites can be detected in peripheral blood smears. Larval ticks and unengorged nymphs placed on a reacting animal, and removed at the next moult to a clean animal to complete their development, have failed to show evidence of stage-to-stage transmission and the progeny of these ticks also failed to transmit *B. argentina* to cattle. On two occasions ticks placed on a reacting animal as larvae and allowed to complete their development on that animal have transmitted *B. argentina* in the next generation. In these cases there was a possibility that parasites were present in the blood during the period of adult engorgement and could have been taken up after the larval stage.

B. argentina is transmitted to cattle by larval ticks. Transfer of infected larvae at the end of the larval stage to clean animals has always failed to obtain transmission by the nymphs or adult stages.

The minimal period of larval attachment necessary for transmission has not been determined accurately; transmission has occurred when larval ticks have been left on an animal for four days, and on one occasion infection resulted after a period of two days' attachment by larvae. This has an important application to susceptible cattle passing through infested areas.

The work suggests that the progeny of known infective ticks lose their infection if matured on an immune animal. However, if the immune animal shows parasites in the blood during the period of adult attachment, ticks matured on it can become infected. This point will be more fully investigated because of the bearing it has on the epizootology of the disease.

Once again attempts to infect ticks with the laboratory strain of *B. argentina* used in routine immunisation of cattle against tick fever were unsuccessful. Comparable experiments using field strains of *B. argentina* have always been successful.

Nymphal and adult *Boophilus microplus* were found capable of transmitting *Babesia bigemina* in one experiment but repeated attempts failed to demonstrate transmission by larvae. The work suggests that the nymph is the important stage of the parasite involved in transmission of the disease.

Ticks attaching to experimentally infected cattle are known to be regularly infected if parasitaemia coincides with maturation of adult female ticks. When and if the nymphal and larval stages become infected has not yet been determined.

Some particularly interesting information has come from feeding *Boophilus microplus* on unfavourable hosts. When ticks infected with *Babesia bigemina* were matured on a goat and a sheep the infection persisted in the subsequent generation, babesiosis occurring in cattle to which the progeny were attached. This is in line with work done in Africa with *Babesia canis.* Blood drawn from the sheep 14 days after attachment of the infective larvae, on sub-inoculation into a bovine animal set up *B. bigemina* infection. This work will be repeated as it has very important implications.

Passive Immunity Conferred by Dam to Calf.—Previous experiments had shown that infection of cows with *B. argentina* by blood inoculation during pregnancy conferred a passive immunity for about six weeks. In an experiment nearing completion, in which infection was induced by tick infestation, an even more desirable degree of immunity was conferred.

Blood Vaccine Studies.—Blood from two animals infected with single pure strains of *B. bigemina* and *B. argentina* mixed and held at 5°C. for seven days, and then allowed to stand at room temperature for 24 hours, resulted in infection in three of five animals with *B. bigemina* and all five with *B. argentina.* Blood stored in the refrigerator for periods of 2-6 days produced infection in every animal into which it was inoculated. This information may have value in subsequent modifications of vaccine.

Work is in progress to determine whether blood from donor animals may produce more satisfactory reactions at certain stages after infection than at others. Marked variations occurred in comparable groups of animals inoculated with blood taken on different occasions from the one donor.

Information is being collected on the effect of age, sex and breed on resistance to tick fever infection. It is of interest that very young calves do not seem to be more susceptible than older animals to tick fever infection. This is in contrast to the effect of bacterial infections. It suggests that non-humoral factors may be as important in babesiosis as they are held to be in malarial infections.

Some years ago it was observed that Zebu cattle and their hybrids showed greater resistance to *B. argentina* infection than the European breeds. It seems likely that this finding will also apply to *B. bigemina* infection.

As mentioned previously, there is considerable variation in the length of time that bleeders will effectively transmit *B. argentina* infection—one animal has produced infection in susceptible cattle for 20 months, while another was effective for less than five months.

Preliminary experiments indicate that an animal that has been inoculated with and reacted to a vaccine strain of Babesia and which has subsequently achieved "self-cure" may not react when re-inoculated with the original strain. However, exposure to a field strain soon after may produce a reaction.

Information on Other Tick-borne Parasites.—Some observations on the tick transmission of the cattle spirochaete, *Borrelia theileri,* have been made. The prepatent period is approximately the same as for *Babesia bigemina*—about 14 days. Transmission takes place with both nymphal and adult *B. microplus.*

Observations by the University Veterinary School indicate that the species of *Eperythrozoon* commonly seen at the Animal Research Institute is not *E. wenyoni*. However, the latter organism is known to be present in Queensland. So far, tick transmission of the unnamed *Eperythrozoon* has not been demonstrated.

Equine Infectious Anaemia

In the last report, a viral disease of horses with many features in common with equine infectious anaemia was described. This disease had not previously been known to occur in Australia. Equine infectious anaemia is a difficult disease to diagnose precisely because there is no specific test yet available to identify it. As a means of identifying the Queensland disease more accurately, serum from infected horses was taken to Japan during the year and injected into horses infected with equine infectious anaemia and uninfected control animals. No reaction occurred in the horses infected with equine infectious anaemia. The controls showed febrile reactions and the blood changes in these were identical with those of equine infectious anaemia and those observed at the Animal Research Institute.

Pathological material from horses affected in Queensland was compared with similar material from cases of equine infectious anaemia in Japan.

These studies confirmed, so far as can be proved, that the disease in Queensland horses is equine infectious anaemia.

Up to the present, the disease is known to occur on five properties between Rockhampton and Roma. During the year a systematic survey of properties around the known infected ones was commenced with a view to determining the extent of the disease. Twenty-seven properties, with a total population of 1,849 horses, were visited. Approximately 900 of the horses were yarded for clinical inspection and specimens were collected from 367. Red cell counts were made by collecting blood into specially prepared tubes (Zschokkes tubes) which enable a direct reading to be made in the field, and red and white cell smears were made for laboratory examination. The white cell smears were specifically prepared for examination for siderocytes, i.e., white cells containing iron released from destroyed red cells. In Japan the presence of these cells is regarded as a useful diagnostic test for equine infectious anaemia.

Transmission experiments and examination of blood and historical material have not so far disclosed the presence of the disease on other properties. This work, however, is time-consuming, not only in the field but also in the laboratory. Transmission tests are done with horses and a period of 60 days must elapse from the time of injection of suspected material till the result can be classed as negative if no reaction occurs. An attempt is being made at the laboratory to develop a serological test for diagnosis of the disease.

The field survey showed that siderocytes are present in the blood of horses affected with a disease which was not transmitted by blood inoculation to susceptible horses. Equine infectious anaemia is so readily transmitted by this means that it appears that more than one condition is present in the horses here. Blood serum submitted to a United States laboratory showed that the disease now referred to as infectious rhinopneumonitis (previously referred to as influenza) is present in this State.

It may be of significance that certain descriptions of equine influenza recorded in the literature resemble very closely the picture of equine infectious anaemia. Investigations will be directed to differentiating these conditions.

Leptospirosis in Pigs

Transmission of L. pomona Infection by Infected Boars.—A trial was undertaken to explore the role of infected boars in the transmission of the infection to sows by service. Four young boars were infected with a culture of *L. pomona*. All developed an intermittent leptospiruria for a period of 16-21 days. Two boars were selected for mating, each to three clean sows. Each boar was shown to have leptospiruria on the days of service. However, none of the six sows thus exposed became infected or showed agglutinins in the blood.

Vaccination of Pigs against Leptospirosis.—A trial is in progress to determine the immunity produced by vaccination at the time of weaning and before mating. Of the eight pigs in each group, four have been vaccinated and four are kept as controls. All pigs will be challenged during mid- or late-pregnancy with a culture of *L. pomona*.

Sheep Blowfly Experiments

The evaluation of new insecticides for their efficacy in protecting sheep against blowfly strike was continued. The insecticides checked were all of the organic phosphorus group and gave the following results:—

Bayer 1090 when used at a concentration of 0.1 per cent. active principle was not effective when checked three weeks after jetting.

Bayer 1752 gave slightly better results. At a jetting concentration of 0.1 per cent. it was effective for 4-5 weeks; when jetted at 0.05 per cent. it was effective for about 4 weeks.

Bayer 1751 at 0.05 per cent. was still effective 11 weeks after treatment.

"Nankor" (Dow Chemical Co.), also known as "Korlan," was effective for 14 weeks when jetted at a concentration of 0.1 per cent. and 20 weeks at a level of 0.2 per cent.

Diazinon used at a level of 0.02 per cent. was the reference insecticide, and in these trials was effective for 11 weeks.

Ovine Myopathic Disease

Work is still in progress with this disease. Several sheep which had been fed vitamin E and selenium were autopsied. All showed typical lesions on microscopic examination. It seems that for a complete knowledge of this disease, a study of the neuro-muscular junctions will be necessary. This presents technical problems which have not yet been overcome.

Ovine Infertility Diseases

Preliminary investigations of the previously reported Actinobacillus infection were completed and a paper submitted for publication. Experiments designed to determine the natural route of infection were set up during the year, using preputial instillation and oral administration of the organism. Negative results were obtained, possibly due to reduced virulence of the infective agent. A further field case was received and the pathogenicity of the organisms will be investigated.

A complement fixation test has been developed for the detection of the disease. At first, tests were done with a heated suspension of the organism, but later a soluble antigen prepared from disrupted cells of the organism was used. Positive results were found in rams after experimental infection. Tests were also done on serum samples from other animals on the property where the first infected ram originated. Two other rams were found positive. The organism was isolated from one; the other was not investigated. A survey for incidence of antibody is being carried out on samples submitted for other tests. One positive ram was found in samples from 24 properties tested, and this animal was also bacteriologically positive.

Melioidosis of Animals

There has been a wider interest taken in the disease with the reported occurrence of a number of human cases in Townsville. Investigations have continued at Oonoonba over the years. Since 1955, the infection has been detected in 45 pigs, 24 sheep, 13 goats, 3 cattle and 1 horse.

The opportunity was taken to apply the complement fixation test developed at Oonoonba to sheep received in the Townsville area for slaughter. Of 772 sheep

examined, seven had melioidosis as judged by the detection of lesions and recovery of the causal organisms. Not all of them were detected by the serological test.

Soil and water samples were cultured in an attempt to discover the natural habitat of the organism, but without success. This work will be continued and expanded.

TICK FEVER IMMUNISATION

A total of 361 stud animals was immunised at Yerongpilly and 141 at Oonoonba. Requests for immunisation at the stations could not always be met and arrangements were made for considerable numbers of breeding cattle to be immunised on their home territory under the supervision of veterinary practitioners.

VACCINES

The numbers of doses of the various vaccines supplied by the laboratory are set out in Table 2.

TABLE 2

DOSES OF VACCINE SUPPLIED

Vaccine	Yeerongpilly	Oonoonba	Total
Bovine contagious pleuropneumonia	213,750	295,625	509,375
Infectious laryngotracheitis	126,800	..	126,800
Brucella abortus (Strain 19) ..	9,680	..	9,680
Tick fever blood ..	47,803	8,929	56,732

A total of 159 bleeders for production of tick fever vaccine was supplied to stock-owners during the 12 months.

The infectious laryngotracheitis vaccine used in Queensland is made at the Animal Research Institute. It is hoped that in the coming year arrangements can be made for its production elsewhere.

VISITS AND PUBLIC LIAISON

Whilst the function of the laboratory is to provide a support service to the man in the field, it is essential that, from time to time, its work be brought to the notice of the public. The occasion of the 50th Anniversary of the establishment of the Stock Experiment Station (now the Animal Research Institute) at Yeerongpilly was considered an appropriate time for such an event and a public day in December was organised for leaders of industry and civic administration. More than 80 guests were present and during the afternoon the Premier of Queensland (Hon. G. F. R. Nicklin) unveiled a commemmorative plaque.

An Open Day was held in May, specifically for members of the Queensland Dairymen's Organisation and the United Graziers' Association to see the work of the Institute. A series of talks and demonstrations was arranged and was attended by about 150 members and friends.

The Australian Broadcasting Commission arranged a half-hour telecast of the activities of the Institute. Although there are considerable limitations to direct telecasts of this sort, the programme was reported to be satisfactory.

The Wool Research Committee met in Brisbane in December. As a considerable portion of the Institute's research work with sheep is financed by grants approved by the Committee, the Committee was shown the work of the Institute and, in particular, experimental projects.

The Food and Agriculture Organisation's expert panel on bovine contagious pleuropneumonia also visited the Institute following its meeting in Melbourne. Mr. G. C. Simmons (Senior Bacteriologist) attended the meeting in Melbourne as an observer.

The annual visits of students from the Queensland Agricultural High School and College and first-year students of the Faculty of Agriculture were again arranged. Short periods of training were also provided for Colombo Plan students, and students from the Veterinary Science Faculty of both Sydney and Queensland Universities. Members of the Branch were also called upon for specialist contributions to training courses for Departmental officers and for field days.

HUSBANDRY RESEARCH BRANCH

Because of existing facilities, the emphasis in the research work of the branch has been on cattle nutrition. Nutrition studies on pigs are being expanded. Most of the experiments are done under yard or stall conditions, where experimentation can be carefully controlled. The basic information obtained in this manner provides a firm foundation for field trials and subsequent application in the livestock industries. Because of the close association of biochemistry and nutrition, much of the work of the Branch is done in collaboration with the Biochemical Branch of the Animal Research Institute at Yeerongpilly.

The Branch is responsible for the collection, processing and distribution of semen used in the bull proving projects and in an experimental artificial insemination unit in the Samford area. All the bulls used in this work are housed at Rocklea. With the large number of bulls now held, the shortage of cattle accommodation is acute. The position will be relieved when an artificial insemination centre is established on 70 acres of land on the Mental Hospital Reserve at Goodna, which was obtained in April 1960 for this purpose. The erection of this centre will also permit an expansion of the use of artificial insemination in Queensland.

The activities of the Branch for the year are summarised in the following sections.

NUTRITION

Drought Feeding Studies

The experimental work on drought feeding of cattle was extended to include pregnant animals, lactating cows and young calves. These experiments will provide data on survival requirements of these classes of animals, and also further evaluate fodders that can be conserved in some of the beef producing areas.

Feeding Sorghum Silage to Pregnant and Lactating Cows.—In this experiment, 30 Hereford heifers, pregnant for a mean period of 175 days, were allotted to three groups of 10 and fed in bare yards for 24 weeks on the following rations:—

Group I—Silage *ad lib.*

Group II—Silage *ad lib.* + 1½ oz. urea and 14 g. sodium sulphate per head per day.

Group III—Silage *ad lib.* + 2½ oz. urea and 25 g. sodium sulphate per head per day.

On a dry-matter basis, the silage used had a crude protein content of 4.3 per cent. and crude fibre content of 34.1 per cent. The urea was mixed with the top layers of the silage at feeding.

The main findings of this study can be summarised as follows:—

(1) Sorghum silage of this quality was unsatisfactory as the sole feed for pregnant and lactating cows. This was due largely to low feed consumption (6.3 lb. dry matter/head/day) and resulted in marked weight losses in cows prior to calving and during early lactation, weakness in some of the cows and heavy mortality (44 per cent.) in calves after birth.

(2) The addition of 1.5 oz. and 2.5 oz. urea per head per day increased the consumption of silage by 43 per cent. and 62 per cent. respectively, significantly reduced weight losses in

cows, and markedly lowered calf mortality. The calves born to dams receiving 2.5 oz. urea also had a slightly higher average birth weight.

(3) Even at the higher level of urea consumption, slight weight losses occurred in the cows prior to calving, this rate of body weight loss increasing after calving. Cows in this group with an initial mean weight of 850 lb. when 175 days pregnant had lost 236 lb. after a mean lactation period of 60 days.

(4) The overall incidence of dystokias (19 per cent.) and retained placenta (15 per cent.) was high. Some of the dystokias were due to slight mal-presentation of the calf. It seems probable that both of these conditions could be significant factors in causing death in beef cattle that calve during droughts.

(5) Although no deaths occurred in any group, two lactating cows in Group I were very weak at the termination of the experiment and became recumbent within a week of being turned out to pasture. Death would have resulted without supportive treatment. All cows in the other two groups, although poor, were reasonably strong at the conclusion of the experiment.

(6) The average milk yield of Group I, obtained by hand-milking over a 24-hr. period at the end of the experiment, was 485 ml. per cow. This was significantly lower than the 1,245 ml. and 1,062 ml. obtained from the two groups receiving urea.

Early Weaning of Beef Calves.—At the conclusion of the experiment reported above, the 19 surviving calves were weaned and used in a preliminary study on early weaning of beef calves as a drought relief measure. Despite the fact that the calves had access to a creep mixture of lucerne chaff and grain sorghum from four weeks of age, they were poorly grown. The average age of the calves at weaning was 62 days (range 44-77 days) and the mean body-weight was 93 lb. (range 70-142 lb.) The calves were fed *ad lib.* in bare yards with a mixture containing 14.6 per cent. crude protein and consisting of 50 per cent. lucerne chaff and 50 per cent. sorghum grain. The experiment continued for only six weeks as it was considered that the major hazards in early weaning would occur in the initial stages.

All calves gained weight during the experimental period, the average gain being 1.1 lb. per head per day. No deaths occurred, although one calf that gained only 16 lb. in the six weeks commenced to lose weight after being turned out on pasture, and subsequently died. The mean feed consumption for the 6-weeks period was 160 lb. per calf. The average daily consumption per head increased from 3.3 lb. in the first week to 6.9 lb. in the sixth week.

This initial experiment indicates that under certain conditions early weaning is possible, but further work involving larger numbers of calves, other feed mixtures, and more abrupt weaning is necessary before a practical procedure can be recommended.

Effect of Salt on Cattle on a Low Plane of Nutrition.—In the drought-feeding experiment recorded in last year's report, some of the heifers receiving 0.5 per cent. salt in the daily ration of 3 lb. of sorghum grain per head developed oedema of the submaxillary space. This finding prompted an examination of the effect of higher levels of salt on cattle on a low plane of nutrition. A further interest was the possible relationship of salt to the oedema of St. George disease. This disease is usually associated with cattle on a low plane of nutrition.

In the first stage of the experiment, six heifers were fed for 25 weeks in individual concrete stalls on 3 lb. of sorghum grain per day with various levels of salt, either in the feed or in drinking water. Under these experimental conditions, clinical abnormalities, changes in body-weight and variation in biochemical values could not be attributed to average daily salt intakes up to 4 oz. The same animals were then fed for 29 weeks in yards on low-quality sorghum silage *ad lib.* Salt, at the 1 per cent. level, was included in the drinking water. Although the average intake of salt was 4.6 oz. per head per day, only slight oedema developed in one animal and there was no evidence of the marked oedema and the histopathological changes found in St. George disease.

Studies with Molasses and Urea Mixtures

Supplementation in the Drinking Water.—Various methods of supplementing grazing stock with urea have been tested both in Australia and overseas. These include trough feeding, mixing with roughage and pasture spraying. Addition of urea to the drinking water has been considered too risky because of the large variations in intake of water by stock and the known toxicity of urea. In Western Australia, urea has been fed successfully in the drinking water to sheep in pen experiments, but deaths from urea poisoning occurred in experiments in the field.

The use of molasses/urea mixtures in the drinking water may reduce toxicity, but the prevention of mould, yeast and bacterial growth presents a problem. Experiments were therefore commenced to find methods of preventing this microbial growth. Nineteen commonly used fungicides and bactericides were tested under laboratory conditions with water containing 1 per cent. molasses and 0.125 per cent. urea. All of these chemicals were ineffective in controlling microbial growth at economical and/or safe concentrations. Studies were then commenced on the effect of increasing the alkalinity of the mixtures. It was found that if a molasses/urea mixture was made up with saturated lime-water and a film of cetyl alcohol ("Siroseal") formed on the surface, the pH remained at 10-10.5 for at least 14 days and there was no evidence of growth of micro-organisms. A precipitate forms in a solution prepared in this way, but all the nitrogen and 0.09 per cent. calcium remain in solution.

As molasses/urea in the drinking water may provide an alternative means of supplementing grazing animals where trough water is available, further studies are planned.

Daily and Twice Weekly Supplementation.—Twice-weekly or *ad lib.* feeding of supplements is more likely to be applied in practice than daily feeding, because less labour would be involved. Experiments in previous years have shown that, under yard conditions, *ad lib.* feeding from troughs resulted in excessive consumption of both molasses and urea and a high risk of toxicity. Twice-weekly feeding appeared to reduce these disadvantages, so an experiment was carried out to determine whether the response to twice-weekly feeding was similar to that of daily feeding.

Three groups of three Hereford steers were fed for 16 weeks in individual stalls as follows:—

Group I—Bush hay *ad lib.*

Group II—Bush hay *ad lib.* + 1.5 lb. molasses and 3.6 oz. urea per head per day fed daily.

Group III—Bush hay *ad lib.* with the same rate of supplementation as Group II but fed on Mondays and Fridays.

The body-weight changes and hay intakes are shown in Table 1.

TABLE 1

BODY-WEIGHTS AND HAY INTAKES OF STEERS IN MOLASSES/UREA EXPERIMENT

Group	Mean Body-weight* (lb.)			Mean Hay Intake Per Day (Air-dry basis) (lb.)
	Initial	Final	Change	
I	579	511	−68	9·9
II	584	620	+36	16·1
III	584	607	+23	13·7

* Body-weights obtained 16 hours after feed and water withdrawn.

The mean consumption time of the molasses/urea mixture in the group fed daily was 11.5 hours, whereas the times for the group fed twice weekly were 37.5 hours when given three days' supply and 48 hours when given four days' supply.

There was a significant response in body-weight and feed intake with both methods of supplementation, but there was a trend towards a greater response in the group supplemented daily. It is planned to investigate this aspect further under yard conditions with larger numbers of animals per group.

Supplementation of Weaner Cattle on Paspalum Pastures

Studies have been made with dairy-type weaners grazing predominantly paspalum pastures at Rocklea. The stocking rate was low, so that an adequate bulk of pasture was always available.

Three pairs of identical twins and four pairs of fraternal twins between 6 and 10 months of age at commencement were used in each of two experiments. The supplemented group, consisting of one member from each pair, was group-fed 2 lb. per head daily of a mixture of 75 per cent. kibbled sorghum grain and 25 per cent. linseed meal. In both experiments, feeding continued for 22 weeks. Experiment I commenced in June 1959 and continued during winter and spring, whereas Experiment II was from December 1959 to May 1960.

The initial and final body-weights in both experiments are shown in Table 2. The growth rate during and after supplementation in Experiment I is shown in Figure 1.

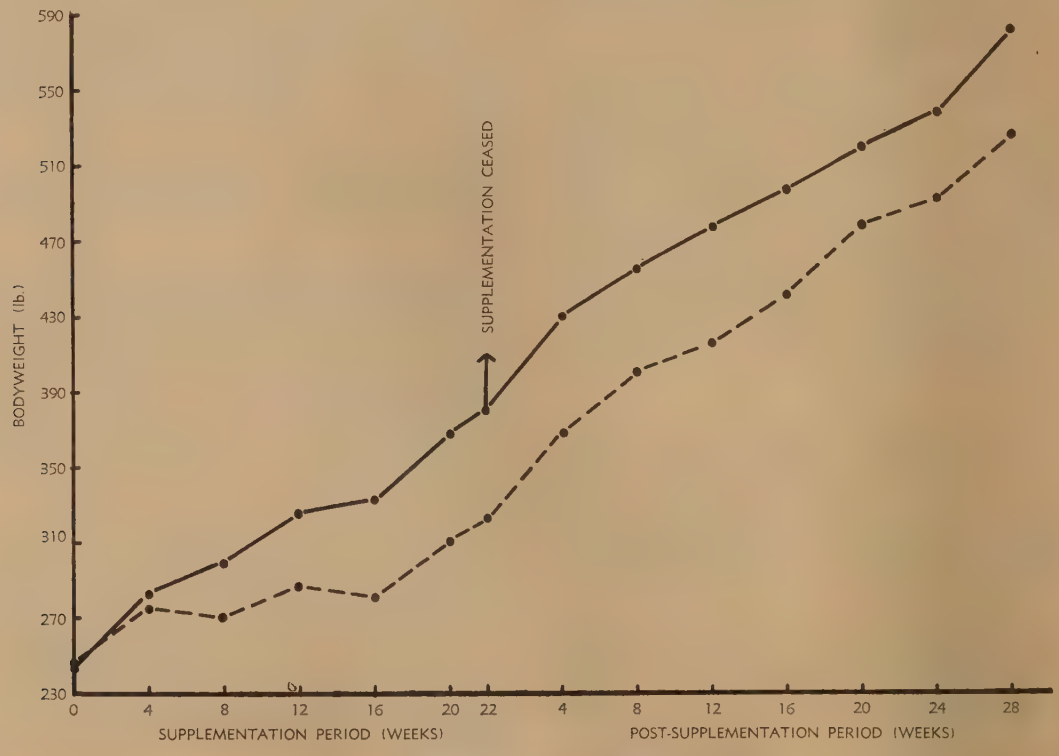


Fig. 1.—Supplementation of Weaner Cattle.

TABLE 2

SUMMARY OF RESULTS OF SUPPLEMENTING WEANER CATTLE

Experiment	Group	Total Supplement Fed/Head (lb.)	Mean Body-weight (lb.)		
			Initial	Final	Gain
I	Supplemented	310	231	365	134
I	Control ..	..	233	303	70
II	Supplemented	310	256	410	154
II	Control ..	..	258	345	87

The 310 lb. supplement resulted in an additional weight gain of 64 lb. in Experiment I and 67 lb. in Experiment II. Much of the advantage in Experiment I occurred in a 10-weeks period from mid-July to late September, when pasture was dry and of poor quality. During this period control animals gained an average of only 6 lb. per head, whereas the supplemented group gained 49 lb. per head. The results of Experiment II may not apply to an average summer/autumn period, because pasture dried off very rapidly due to the very low rainfall in late summer.

Grazing behaviour observations during three 24-hour periods in Experiment I showed only slight differences in the time spent grazing by the two groups.

As shown in Figure 1, the average body-weight advantage of supplemented animals 28 weeks after feeding ceased was still 56 lb. per head. Weighings will continue in both experiments for 12 months after cessation of feeding.

Although the results of these experiments apply to one year only, it appears that calves grazing paspalum pastures will respond, at least during dry periods of the year, to a low rate of supplementation. This would, in turn, allow heifers to be ready for mating at a younger age than would be possible if they had received no supplementary feed.

Rotational Grazing Experiment

The design of this experiment was given in the Annual Report for 1957-58 and progress results were recorded in the 1958-59 report. Two groups of cattle are grazing comparable areas of pasture. One area is subdivided and managed on a rotational system, while the other is grazed on a fixed system. An equal number of the animals in each group are maintained copper-adequate by intravenous injections of copper sulphate, while the remainder show the low copper status which is typical of cattle grazing the pastures at Rocklea. The stocking rate is one beast per acre.

Mean daily weight gains for the groups during the year under review ranged from 0.83 to 0.88 lb. per head, with no apparent differences between groups. These gains are low when compared with those of previous years and are due largely to the failure of summer rains in early 1960. Mean gain in all groups from January 1 to May 5, 1960, was 0.85 lb. per head per day, compared with 1.52 lb. per head per day for the same period of 1959.

In October 1960 this experiment will have been in progress for four years and it is proposed to examine all the results, with a view to terminating the work.

Copper Metabolism Studies

Cattle grazing the predominantly paspalum pastures at Rocklea, in common with dairy cattle grazing similar pastures in some other areas of south-eastern Queensland, are unable to maintain liver copper reserves. This occurs despite a copper content of 8 p.p.m. or more in the pasture available to the animal. Previous work at Rocklea has shown that moderately high levels of inorganic sulphate (0.46 per cent.) and molybdenum (11.5 p.p.m.) in rations can interfere with copper storage in cattle. Studies were made in the past year with paspalum hay conserved at Rocklea and containing 0.35 per cent. inorganic sulphate and 0.1 p.p.m. molybdenum. The results indicated that the factor or factors interfering with copper metabolism are unlikely to be associated with the low level of molybdenum in this pasture.

Digestibility of Wheat and Sorghum by Pigs

In last year's report results were given of an experiment to compare the digestibility of a wheat/meatmeal ration with that of a sorghum/meatmeal ration. This work was extended during the year to enable a direct comparison of the digestibility of wheat with that of sorghum. The sorghum and wheat used were of comparable chemical composition and the comparisons were made over the three liveweight ranges 40-70 lb., 78-138 lb., and 138-180 lb. During the pre-collection and collection periods of each digestibility determination, the pigs were fed the grain under examination, plus adequate vitamins and minerals. The same four pigs were used in each weight range and the results summarised in Table 3 represent the mean of four pigs.

TABLE 3

DIGESTIBILITY OF WHEAT AND SORGHUM BY PIGS

Weight Range (lb.)	Digestibility (%)							
	Wheat				Sorghum			
	Organic Matter	Crude Protein	Nitrogen-free extract	Fibre	Organic Matter	Crude Protein	Nitrogen-free extract	Fibre
40– 70 ..	90·3	91·0	93·1	32·0	88·9	73·7	94·6	70·8
78–138 ..	91·4	93·0	93·7	24·7	89·8	72·3	95·8	78·5
138–180 ..	90·6	92·8	92·9	37·9	89·1	70·5	95·5	77·5

The results obtained this year are similar to those recorded in 1958-59 for wheat/meatmeal and sorghum/meatmeal mixtures. The general agreement between pigs was good and there appeared to be little change in digestibility as the pigs became older.

Being comparatively low in crude protein, the cereal grains are included in pig rations largely to supply energy, and the apparent digestibility of the nitrogen-free-extract indicates that sorghum is at least comparable to wheat on a digestible energy basis. However, the digestibility of the crude protein in wheat appears higher than that of grain sorghum. This could be of importance when the overall protein content of the ration is minimal.

During determinations of digestibility, it was noted that the rate of consumption and intake of wheat was greater than that of sorghum. The pigs were fed twice daily and the feed was allowed to remain before them for 30 minutes. Experiments are therefore being planned to study the palatability of different varieties of sorghum and to compare performance of pigs fed rations based on sorghum grain with that of pigs fed similar rations based on wheat.

ARTIFICIAL INSEMINATION

Bull Proving Project

This project continued on a basis similar to that described in previous Annual Reports. The insemination period was from September 21, 1959 to January 29, 1960, a total of 138 days. The numbers of semen batches despatched were Jersey 55 and A.I.S. 57. Some relevant details are summarised in Table 4.

TABLE 4

DETAILS OF INSEMINATION AND RESULTS FOR 1959 BULL PROVING PROJECT

Breed	No. of Co-operating Farmers	Volume of Semen Despatched (ml.)	Total Inseminations	First Insemination Non-return Rate (60–90 day) (%)
Jersey ..	48	4,825	2,559	50·6
A.I.S. ..	48	4,325	2,334	49·6

The non-return rate in this project is adversely affected because it is not possible to use semen on the day of collection. Nevertheless, the results from first inseminations this year were lower than expected. In the Jersey project, the non-return percentage was considerably lower than in some previous years, the poor fertility of one of the bulls partially contributing to this result. The figures for the A.I.S. project were slightly higher than for 1958-59, the first year in which this breed was used.

A slight modification was made to the semen diluent. The phosphate buffers previously in use were omitted during the later portion of the insemination period, because experimental work and field use in other artificial insemination centres have shown that the inclusion of these buffers does not result in an improved conception rate. The diluent now in use is 50 parts egg yolk, 50 parts 3 per cent. sodium citrate, with 500 units of each of the antibiotics, penicillin and streptomycin, per ml. of diluent.

Collections from the Jersey bulls used this year were of lower volume and more dense than those from the A.I.S. bulls of similar age. However, the total number of spermatozoa in first collections was comparable in the two breeds. This finding is similar to that recorded during 1958-59.

Some of the daughters sired by the first four Jersey bulls of the project, which were used in 1955-56, completed their first lactation and the production data, obtained by the Herd Recording Section of the Division of Dairying, were analysed by the Cattle Husbandry Branch. The results of the analysis appear in the report of that Branch.

The young bulls that are obtained for the Bull Proving Project are being used in a long-term study on comparative sexual maturity of the two breeds. This work commenced during 1959, and as only four bulls of each breed are being purchased per year, it will be some years before reliable figures are obtained.

Samford Unit

This Unit was commenced by the Department in June 1959 and was in operation throughout the year. Chilled semen is being supplied two days a week. Semen from A.I.S. bulls is being used routinely, although some Jersey semen was also available for a short period. In the period June 1959 to February 1960, 512 first inseminations were done with semen from Rocklea. The non-return rate (60-90 day basis) was 72.5 per cent.

BIOCHEMICAL BRANCH

The Branch serves two main functions. It provides a diagnostic service, which is receiving an ever-increasing number of specimens. It also initiates or collaborates with other Branches in investigations on problems of major importance to the livestock industries in Queensland. Some success in the research field is evidenced by the 18 papers which have been published in scientific journals within the last nine years by officers of the Branch, either singly or in collaboration with officers of other Branches.

Biochemical determinations are playing an increasing role in studies on animal health. In nutrition, too, there is an increasing emphasis on biochemistry. Whether the problem is one of feeding for survival in times of drought or feeding for optimum production, the ultimate unknown is a basic understanding of feed requirements and feed utilisation. These are biochemical problems. In Queensland there is no shortage of problems awaiting research. Although there have been some successes there are many unknowns. Any future expansion of research in the Biochemical Branch is dependent on additional facilities but primarily on additional laboratory space to house these facilities.

The Branch at present consists of two sections, toxicology and biochemistry. The diagnostic service and the current research interests are presented in the reports from each section.

TOXICOLOGY SECTION

Diagnostic Service

Specimens were received from 327 cases where poisoning of livestock was suspected. Analyses confirmed arsenical poisoning in 53 cases, lead in 13, strychnine in 3 and phosphorus in 1. In addition to these biological specimens, a wide variety of miscellaneous samples were examined. These included suspected sources of arsenic and lead, plant specimens for nitrate and hydrocyanic acid, proprietary mashes, stock waters, drenching fluids and some proprietary fluids used as sprays. An unusual example was a proprietary labelled DDT which was suspected of causing deaths in cattle following spraying for buffalo fly control. This was tested on calves and proved toxic while subsequent analyses showed the presence of a high concentration of endrin.

The development of tickicides containing organic phosphorus compounds which are stable in dipping vats has necessitated either the testing and adaptation of known methods of analyses or in one case the development of a new method. Of the 827 samples submitted from dipping vats located throughout the State, 112 were arsenical preparations, 26 were organic phosphorus compounds and the remainder chlorinated hydrocarbons. The objective of this service is to use chemical analyses to ensure the maintenance of the tickicide at effective economic strength in the dipping vat. To attain this objective methods of analysis must be rapid and sufficiently accurate for adequate advice. Analytical findings must be reported promptly and field officers and private owners must adhere to the comprehensive instructions on maintenance, stirring and sampling of vats. The large number of samples submitted each year indicates the satisfactory nature of this service to producers.

Investigations

Selenosis.—The two areas so far incriminated in Queensland are Cape York Peninsula and north-western Queensland in the vicinity of Richmond. In the former, *Morinda reticulata* was shown to be the selenium accumulator plant and control measures involve mustering horses off areas carrying this plant, particularly during the period of its regrowth. In the latter, further investigations have been made and although a large number of analyses have yet to be completed some general conclusions are possible.

The presence of selenium in north-western Queensland is associated with certain limestone outcrops. These outcrops occur sporadically over a wide area but are extensive on the property where acute selenosis was first diagnosed. Acute toxicity is associated with the vegetation growing on soils receiving the runoff from these outcrops. *Neptunia amplexicaulis* is certainly a selenium accumulator plant and could be an indicator plant. Selenium concentrations in this plant range from 10 to 4,000 p.p.m. on dry matter. The disorder of wool shedding has been a problem in this locality for many years and there are indications that this could be a chronic form of selenosis in sheep. Further investigations will involve determining the form in which selenium occurs in this plant and feeding trials to see if wool shedding can be induced in experimental sheep.

Poison Plants.—Some progress was made in the identification of the active principle in *Acacia georginae.* This has always been a part-time investigation undertaken only when pressure of other work permitted. A relatively pure crystalline material has been isolated. This is highly toxic to rats and its chemical structure is being determined. At the same time, sufficient quantity of this material is being prepared to correlate laboratory toxicity testing with clinical and pathological findings, using sheep as test animals.

Persistence of DDT on Cattle Hair.—Previous investigations have shown a marked difference in persistence of DDT on the hair of cattle stalled indoors compared with that of grazing cattle. This could be due to a number of factors, including weathering, sunlight, coat characteristics, and coat licking. These factors were evaluated on Hereford steers during midsummer. Twelve animals were paired with respect to coat characteristics. The right side of the barrel was scrubbed on all animals and anti-licking harness was attached to three animals in each of the indoor and outdoor groups. In both groups animals fitted with anti-licking harness were maintained separately. Following dipping, hair samples were taken daily for 21 days from three 2 in. squares on each side of each animal. These squares were taken according to a statistically randomised pattern and were bulked for analyses. In this investigation coat licking was the major factor affecting the persistence of DDT on cattle hair.

BIOCHEMISTRY SECTION

Diagnostic Service

Blood inorganic phosphate analyses were made on 900 samples representing 145 different properties. On 56 of these properties a diagnosis of phosphate deficiency was confirmed, while on 36 other properties the phosphate status of livestock was marginal. Figure 1 has been compiled from the data on diagnostic samples

received in the four years 1956 to 1960 and shows the distribution of phosphate deficiency as judged solely on samples submitted during these four years. Each dot represents the location of a property in which phosphate deficiency has been confirmed by blood analyses.

Liver copper analyses were done on 117 samples representing 77 different properties. A diagnosis of copper deficiency was confirmed on 15 properties. Blood copper levels were determined on 850 samples representing 123 other properties. A diagnosis of copper deficiency was confirmed on 23 properties while a further 11 showed a marginal copper status in grazing

livestock. Figure 2 shows the distribution of copper deficiency based solely on analysis of liver or blood diagnostic samples submitted in the four years 1956-1960.

Liver vitamin A analyses confirmed the field and pathological diagnosis of vitamin A deficiency in fowls from 13 properties and pigs from 3 properties. A marginal vitamin A status was indicated on a further 4 poultry and 3 pig farms.

Suspected metabolic disorders involved the analyses of 221 sera for calcium and 157 for magnesium. Hypocalcaemia was confirmed on 10 occasions, six times in association with hypomagnesaemia and twice with an accompanying hypermagnesaemia. There were three instances of hypomagnesaemia where the calcium level in blood was normal. Although these findings do not indicate a high incidence of metabolic disorders they are indicative of what can be expected with increased productivity.

Workers overseas have shown that metabolic disorders are largely associated with high-producing animals and it is hoped that the world-wide research on these problems will furnish some of the answers in the immediate future, including a satisfactory and economic prophylaxis.

Of the 2,600 miscellaneous samples analysed, some 500 were concerned with animal health and the remainder with field investigations by other Branches. Analyses included haemoglobin and haematocrit determinations on blood; differential serum protein analyses; bones for ash and fluorine content; urinary calculi for complete analysis; feeds for carotenoids, beta-carotene and vitamins A, B, and B_2; stockfood analyses on a variety of foodstuffs; silage for quality tests; and a variety of pasture samples for trace element analyses.

Investigations

Copper.—The Branch is associated with two types of investigations on copper deficiency in cattle. One is an intensive study on the cause of a low copper status in cattle grazing predominantly paspalum pastures at the Rocklea Animal Husbandry Research Farm. The other is concerned with two extensive field trials to measure the influence of parenteral copper therapy on growth of weaners. The two areas selected are marine plains, one in the vicinity of Rockhampton and the other near Townsville.

Essential findings from work at Rocklea are—

(1) The cause of the low copper status in cattle appears to be an interference with copper metabolism rather than a low copper status in pasture.

(2) From pen experiments both cattle and sheep show a similar behaviour to the influence of molybdenum and inorganic sulphate on copper metabolism.

(3) In general, sheep maintain good copper reserves while cattle show a low copper status although grazing the same pasture.

(4) The molybdenum level in pasture is low, being usually less than 0.2 p.p.m. on dry matter, so that molybdenum and sulphate are unlikely to be the factors interfering with copper metabolism by cattle.

(5) Grazing cattle tend to show the lowest copper status when the pasture is at the young growing stage.

(6) In spite of the low copper status in cattle there is no marked response in growth rate from copper therapy. The data are being assembled for publication.

Phosphate.—Research interest has been in the development and application of regressions relating phosphate, calcium and protein in feed and faeces. These studies have shown:—

(1) The regressions are adequate for survey purposes for the variety of pastures encountered in south-eastern Queensland.

(2) Where cattle are supplemented the regression for phosphate is satisfactory but that for protein can underestimate the protein content of the diet.

(3) Grazing cattle show a high degree of selectivity and for the diet selected the concentration of phosphorus, calcium and protein is usually adequate for at least moderate production.

(4) Low production in the milking herd appears to be due to low feed intake caused by an insufficiency of palatable fodder. A more serious cause of low production is the low initial peak production, which is related both to quality and to quantity of feed available to dry cows.

(5) On the properties so far examined the phosphate deficiency appears to be a low phosphate intake rather than a low phosphate concentration in the pasture selected. An exception is in the Kingaroy area, where the diet is low in phosphate and there is also a wide Ca:P ratio.

(6) The incidence of anoestrus in dairy cattle is inversely related to production and this in turn appears to be related to the overall plans of nutrition rather than to a specific deficiency such as phosphate.

Urea and Molasses as a Pasture Spray.—This has been evaluated on two types of pasture, one predominantly *Paspalum dilatatum* and one predominantly *Axonopus affinis.* On the latter pasture, studies were made in two successive years. The growth rate of young Hereford cattle was used as an index, matched control animals being located on an adjacent similar but untreated paddock. Pasture spraying with a preparation containing 78 per cent. molasses, 12.5 per cent. urea and 4.4 per cent. monosodium phosphate was made in strips at weekly intervals throughout the winter months from April to September.

This pasture spray did not influence the growth rate of cattle either in a favourable winter when cattle maintained weight or in the more usual unfavourable winter when cattle lost weight. These findings tend to be contrary to those being reported from South Africa. It is suggested that the Queensland findings are due to the high degree of selectivity shown by grazing cattle in south-eastern Queensland and the apparent failure to increase the palatability of treated pasture for longer than 24 hours after spraying. These findings have been presented for publication.

Drought Feeding Experiments.—A major research interest of the Husbandry Research Branch has been to determine the food requirements of different classes of cattle for survival in times of drought. The fodders

being evaluated are those produced in quantity in Queensland, viz. sorghum grain, sorghum silage and bush hay. Urea is favoured as a protein supplement on the score of cost, availability and ease of handling. The Biochemical Branch is collaborating in these studies to obtain basic information on the experimental animals at the commencement, during and at the end of each feeding experiment as well as during recovery when cattle are transferred to pasture. Measurements include prothrombin time; blood haemoglobin, packed cell volume, red cell count, and inorganic phosphate; serum calcium, magnesium, total protein, albumin and globulin; plasma chloride, sodium, potassium and non-esterified fatty acids; liver vitamin A; plasma volume and extracellular fluid volume.

The data on maiden Hereford heifers fed at the rate of 3 lb. grain sorghum per head per day either daily, twice-weekly or weekly have been assembled for publication. One group receiving additional sodium chloride showed oedema. Based on these findings there is an obvious need for further study on, firstly, the normal biochemical values for beef cattle and, secondly, the effect of sodium chloride fed to cattle on a low plane of nutrition. A long-term trial has been in progress for 12 months. Six Hereford calves are being examined at 2-monthly intervals to determine seasonal and age variation in a wide variety of biochemical values.

The effect of the ingestion of various levels of salt by cattle has been examined in stall-fed Hereford heifers on restricted grain feeding and in pen experiments where a small group was maintained solely on sorghum silage. Although valuable additional data were obtained on a variety of biochemical values, oedema could not be related to salt intake under these experimental conditions.

Drought feeding studies are in progress to evaluate grain sorghum for pregnant and lactating cattle and biochemical data are being collected.

Conserved Fodder.—Experimental tower silos of about ¾ ton capacity were used to evaluate sodium metabisulphite and molasses as additives to paspalum silage from pasture cut in 1-3 in. lengths by a forage harvester. The former was added at 8 and 16 lb. per ton of green pasture and the latter at 40 and 80 lb. per ton. Fermentation loss, quality, palatability and digestibility were used as indices to evaluate each additive. The findings are:—

(1) Fermentation losses were least in the silages containing molasses.

(2) Quality tests favoured silages containing molasses. These silages showed a lower pH, a higher acid concentration, a better lactic acid to acetic acid ratio, and less breakdown of protein.

(3) Palatability was greater in silages containing additives, the product containing 8 lb. metabisulphite being the most palatable. However, this product was very susceptible to mould growth on exposure to air. The product containing 16 lb. metabisulphite was variable, the lowest one-third being most unpalatable.

(4) There appears to be little advantage from the molasses at 80 lb. per ton when compared with the product containing 40 lb. per ton.

(5) Digestibility trials were completed but some analyses have to be finished before the data can be examined.

A further study is in progress to compare silages made with and without molasses from paspalum harvested with both the cutter-bar and flail-type harvesters.

Protein Quality.—The basic components of meat-and-bone meals are tissue, blood and bone. There is theoretical and experimental evidence that protein quality is variable and is related largely to the relative proportion of the components. The use of additional bone not only increases the mineral content and thus lowers total protein, but also contributes more of the poorly digestible bone protein. Increasing amounts of blood are then used to maintain the crude protein content of the product.

Protein quality studies are therefore concerned with (1) assessing the effect of various quantities of blood and of bone on the biological value of the protein; (2) determining the maximum amount of each that can be added and still supply a satisfactory product; and (3) based on these data, devising recommendations for control regulations to ensure that maximum permissible levels for blood and bone are not exceeded in products marketed in Queensland. Feeding trials with chickens are in progress to evaluate, firstly, increasing levels of blood and, secondly, increasing levels of bone. Growth rate and feed conversion are indices. Rations are isocaloric. The level of crude protein in the diets is that used in commercial practice.

Further measurements on both gross protein value (G.P.V.) and "available" lysine have confirmed their limitations as indices of protein quality. The former is time-consuming, costly and rather insensitive and fails to give a high degree of reproducibility. The latter is unsatisfactory for products containing variable amounts of blood, as blood contains more lysine than does tissue. The available lysine test is most useful in demonstrating faults in processing, such as overheating, which lower available lysine.

It has been necessary to defer further investigation using gross protein value measurements. When undertaken they will involve amended methods of calculation and slight modification in procedure. Investigations will be to evaluate the influence of storage on the quality of meat-and-bone meal and to examine an apparent breed difference in protein utilisation.

SHEEP AND WOOL BRANCH

EXTENSION WORK

Sheep owners' requests to field officers for advice and demonstrations during the year indicate to some extent the problems of the industry. Figures showing the number of times on which field officers have given advice and demonstrations in the different aspects of sheep husbandry show an increase on those for the previous year. An analysis indicates that sheep owners wish to use methods of husbandry which will increase their cut per head, so reducing their running costs and accordingly increasing their net return on capital invested. Problems of sheep breeding and parasite control have again been the main aspects of sheep husbandry on which field officers have worked. Over 76 per cent. of all extension work was in connection with these two subjects. Feeds and feeding were next in importance.

Seasonal conditions were not as favourable for sheep parasites as in recent years. However, the impact of internal parasites on growth, wool production and fertility seems to have been more widely appreciated than formerly, so that precautions against them are being taken more frequently. The development of resistance by the blowfly to some of the chlorinated hydrocarbon insecticides has awakened interest in the more basic methods of fly control such as correct tail length, tail strip and the Mules operation. This has resulted in an increase in the number of properties doing the Mules operation in some areas. In one area where the Mules operation was not previously done, 17 adjacent properties are now Mulesing their sheep. The results obtained in this area will largely influence neighbouring properties to take up these methods for controlling the blowfly.

The continuous increase in the requests received by field officers for advice and demonstrations on breeding plans probably results from the desire of the sheep owner to increase wool production in times of relatively low wool prices and high costs. Though these requests have not resulted in a large increase in the number of

wool samples submitted to the Wool Biology Laboratory, it has resulted in properties other than the studs selecting the heavier wool cutting sheep either by weighing or by using the services of a person more experienced in selecting the heavier cutters through his association with fleece weighing.

An opportunity is afforded for graziers and field officers to meet and discuss their problems at field days. This opportunity serves the double purpose of allowing techniques to be demonstrated to a number of interested sheep owners at the one time and discussion of the advantages and difficulties of applying the technique in routine management. Field officers participated in 25 field days during the year.

WOOL BIOLOGY LABORATORY

Even though some studs in the drought areas have not been able to take advantage of the Wool Biology Laboratory, there was a slight increase in the number of wool samples received at the Laboratory during the year to a total of 4,138 samples. The samples sent in for measurements such as fibre diameter and staple length increased by almost 400 to 3,512. The majority of the larger studs are now using the Laboratory to have measurements and calculations made on their reserve rams. As progress made in these studs will be passed on to commercial wool producers who use their rams, the Wool Biology Laboratory is making a wide contribution to the industry in the resulting increased cuts per head.

NUTRITION

The rainfall throughout the sheep areas has been in general of uneven distribution, with the result that pastures within even a small area have been variable. Because of the costs involved there has been only limited hand-feeding of stock. In the south-western sheep district there has been some mulga feeding. Although it has not been possible to run controlled experiments under these drought-feeding conditions, general observations indicate that the feeding of a phosphate lick improves the condition of the sheep. In the more easterly sheep areas towards the western and southern slopes of the Darling Downs, the provision of winter crops has greatly aided lambing ewes.

EXTERNAL PARASITES

All the organic insecticides in common use continue to give good control of body lice. The incidence of leg itch mite (*Trombicula sarcina*) has not increased. Further cases of itch mite (*Psorergates ovis*) were diagnosed in the south-eastern sheep areas, but the incidence of the parasite did not appear to be greater than in previous years.

The incidence of blowfly activity was below average. The organic phosphorus insecticides now being used continue to give adequate protection. There is no field evidence of resistance developing to these insecticides. There was an increase in the number of properties performing the Mules operation. When the whole ewe flock has been Mulesed on these properties they will be in a better position to control fly strike should the fly develop further resistance to insecticides.

FAT LAMB PRODUCTION

Though wool production from Merino sheep is the main source of revenue from Queensland's sheep, fat lamb production, though still not large, has shown a steady increase, particularly during the last three years. Of Queensland's sheep population, only 420,000 are breeds other than Merino, of which number about 400,000 are comebacks, crossbreds or Corriedale. Of these non-Merino sheep, 310,000 are grazed and crop-fed on the Darling Downs, where almost all of the State's fat lambs are produced. The less temperate climate of this area, its irregular rainfall and periodical droughts make fat lamb raising in Queensland a more hazardous undertaking than in the southern States. However, its proximity to the Brisbane market and the high cost of other meats has generally assured a fair market for lambs produced. Fat lamb production in this area is, at best, associated with some agricultural activity, of which grain-growing is the commonest. The suitability of winter crops such as oats, wheat, rape and turnips for lamb growth has evolved a practice of Darling Downs fat lamb farmers joining their rams in November and December. Joining at such a time, however, presents some difficulties with lambing percentages, as the sheep are joined at a time when their reproductive ability is not optimum.

The total sheep population of the Darling Downs has increased greatly since 1952. The greatest increase has been in Merino sheep, but the other breeds have also shown an increase, as indicated by Table 1.

TABLE 1

DARLING DOWNS SHEEP POPULATION INCREASES

Year	Total Sheep	Merino	Breeds other then Merino	Breeds other than Merino as a percentage of total
1952	2,518,084	2,357,749	160,335	6·36
1955	3,401,424	3,159,614	241,810	7·11
1957	3,902,689	3,624,441	278,248	7·13
1958	3,770,572	3,460,177	310,395	8·23

The number of lambs slaughtered at Queensland meatworks has increased considerably, as shown in Table 2. About one-quarter come from the northern border areas of New South Wales.

TABLE 2

LAMB SLAUGHTERINGS AT QUEENSLAND MEATWORKS

Year July to June	Number Slaughtered
1953–54	91,544
1954–55	87,630
1955–56	112,171
1956–57	140,338
1957–58	158,655
1958–59	215,433
1959–60	271,000 (Estimated)

TOORAK FIELD STATION

During the past year the main investigational work at the Toorak Field Station was concentrated on sheep fertility and production and on agricultural investigations designed to produce feed for supplementary and drought feeding.

Joining and Lambing Trial

The nucleus flock at the Toorak Field Station was founded on sheep born and reared in the northern environment. The foundation stock were ewes born in 1950 and were typical of a strain of sheep run in that area. As the aim of this study is to obtain information on the life-time productivity and fertility of these sheep, no culling is practised.

Joining for the past year commenced on April 6, 1959, and extended to May 17. Ewes were run with raddled teasers and marked ewes were mated (hand-served) with 16 selected rams. All ewes were run with teasers for a further period of three weeks from May 18 to June 7, 1959, in an attempt to determine the conception rate.

The ewes joined were the survivors from previous joinings plus the 1957-drop ewes from this flock. The age groups of the ewes were 1950 drop and 1953 to 1957 drop inclusive.

The ewes were divided into three groups as follows:—

One-third chosen at random = Random Group

One-third chosen for low wrinkle score = Plain Group

One-third chosen for high wrinkly score = Wrinkly Group

Half the rams used were 18 months old and half were 2½ years old. Half of each age group were selected for freedom from skin folds and half were selected for wrinkledness. Half of each group were fully hand-fed prior to and during joining, while the other half were on natural grazing. Prior to the start of joining all rams were examined by manual palpation and semen evaluation; the apparent fertility of all rams used was high.

At joining, Random Group ewes were mated at random to Plain and Wrinkly rams. All Plain Group ewes were mated with Plain rams. All Wrinkly Group ewes were mated to Wrinkly rams.

Plate 36.—An earthen tank holding 19,000 cubic yards in the north-west.

Plate 37.—Mulga pushed over for feeding sheep in drought in the south-west.

Plate 38.—Lamb marking in cradles.

TABLE 3

CONCEPTIONS AND LAMBING PERCENTAGES

	All Ewes			
	Plain Group	Random Group	Wrinkly Group	Total
Ewes showing oestrus during joining	150	168	150	468
Ewes that apparently conceived (as percentage of ewes showing oestrus)	126 (84%)	135 (80%)	106 (71%)	367 (78%)
Ewes lambed (as percentage of ewes showing oestrus)	99 (66%)	99 (59%)	71 (47%)	269 (57%)
Ewes that did not lamb	16 (10·6%)	22 (13%)	24 (16%)	62 (13%)
Ewes missing at lambing	11 (7·3%)	14 (8%)	11 (7%)	36 (8%)
Ewes that died during lambing	1	3	1	5

TABLE 4

PERFORMANCES OF RAMS

Ram No.	Classification on skin folds	Feeding	Age	× Plain Ewes	× Wrinkly Ewes
			(Years)		
1	Plain	Hand-fed	1½	14/23 (61%)	3/4 (75%)
2	Plain	Hand-fed	1½	8/17 (47%)	1/3 (33%)
17*	Plain	Hand-fed	1½	12/19 (63%)	2/6 (33%)
5	Plain	Hand-fed	2½	12/29 (41%)	1/3 (33%)
6	Plain	Hand-fed	2½	11/25 (44%)	3/5 (60%)
3	Plain	Native pasture	1½	12/27 (44%)	2/5 (40%)
4	Plain	Native pasture	1½	15/30 (50%)	3/4 (75%)
7	Plain	Native pasture	2½	12/27 (44%)	1/4 (25%)
8	Plain	Native pasture	2½	16/28 (57%)	0/3 (0%)
9	Wrinkly	Hand-fed	1½	1/5 (20%)	4/25 (16%)
10	Wrinkly	Hand-fed	1½	3/6 (50%)	9/27 (33%)
13	Wrinkly	Hand-fed	2½	2/3 (67%)	13/34 (38%)
14	Wrinkly	Hand-fed	2½	2/8 (25%)	6/26 (23%)
12	Wrinkly	Native pasture	1½	0/4 (0%)	3/31 (10%)
11	Wrinkly	Native pasture	1½	1/3 (33%)	21/31 (68%)
15	Wrinkly	Native pasture	2½	1/5 (20%)	16/28 (57%)
16	Wrinkly	Native pasture	2½	3/3 (100%)	9/27 (33%)

* Ram No. 17 substituted for Ram No. 2, which died on the 18th day of joining.

Over the whole flock the oestrus percentage was high, as in previous years.

The apparent conceptions and lambing percentages within the three groups (Plain, Random, and Wrinkly) for 468 ewes which showed oestrus during joining are shown in Table 3.

These figures are in general agreement with the indication reported last year that within this flock plain-bodied ewes are more likely to lamb than ewes with a high fold score. On this occasion there was very little difference between the survival rate of lambs born to plain-bodied ewes and lambs born to wrinkly ewes. The lamb-marking percentages based on ewes served were 66 for the Plain Group and 43 for the Wrinkly Group. While these figures support the indication of higher fertility of plain-bodied ewes, further observations in other seasons are required.

The percentage of ewes with sound udders was 86, 85 and 85 in the Plain Group, Random Group and Wrinkly Group respectively. As in previous observations, the survival of lambs to ewes with unsound udders was lower (55 per cent.) than to ewes with sound udders (80 per cent.).

Table 4 shows for each ram the proportion of successful services, i.e. ratio of number of ewes lambed to service to number of ewes served during the six weeks' joining. The classification of rams as plain or wrinkled on skin fold score and the method of feeding during joining are also indicated in the table.

Though the number of sheep is not large and further observations over a number of years are required, it is interesting to note that the average percentage of conceptions obtained when plain-bodied rams were joined with plain-bodied ewes was 50 (ewes lambed to ewes served), while the average for wrinkly rams joined to wrinkly ewes was 34.7.

The numbers of ewes fro mthe Random Group which were joined with rams of the opposite wrinkle score, i.e. plain-bodied ewes with wrinkly rams or wrinkly ewes with plain-bodied rams, are too small to allow any assessment of the importance of wrinkles on the male or female side.

The birth weights and gestation lengths for single lambs sired by each of the 17 rams used are as shown in Table 5.

TABLE 5

BIRTH WEIGHT AND GESTATION PERIOD OF LAMBS BY SIRES

	No. of Lambs	Birth Weight (lb.)	Gestation Length (days)
Ram—			
1P*	18	8·2	150·5
2P	7	8·6	150·7
17P	13	8·2	151·3
5P	16	8·5	150·9
6P	16	8·2	150·6
3P	18	8·5	150·1
4P	14	8·9	151·5
7P	10	9·0	150·8
8P	15	7·9	149·4
9	4	7·3	152·0
10	14	8·5	150·5
13	16	8·0	149·9
14	7	7·0	150·4
12	2	6·5	149·5
11	19	8·1	151·4
15	21	7·9	151·5
16	11	8·6	150·7

* P = Plain-bodied (low skin fold score).

The average birth weight and gestation length for the lambs of all sires are shown in Table 6.

TABLE 6

BIRTH WEIGHT AND GESTATION LENGTH FOR ALL SIRES

Lambs	Birth Weight	Gestation Length
	(lb.)	(days)
Male singles	8·4	150·6
Female singles	8·0	150·9
Male twins	6·9	150·2
Female twins	6·3	149·6

The body-weights and daily weight gains of lambs from birth until December 14, 1959, when classified according to the fold scores of the dams, were as shown in Table 7.

SHEEP RESEARCH

Plate 39.—The main buildings on "Toorak" Field Station in the Julia Creek district, operated by the Sheep and Wool Branch.

Plate 40.—A bore drain on "Toorak" Field Station.

Plate 41.—Raddling a sheep for a mid-side sample of wool for examination in the Department's Wool Biology Laboratory.

Plate 42.—Weighing the fleece, another stage in fleece-testing procedure.

TABLE 7

LAMB WEIGHTS AND GAINS ACCORDING TO EWE TYPE

Lambs	Plain-bodied Dams		Wrinkly Dams	
	Average Weight at 14/12/59	Daily Gain	Average Weight at 14/12/59	Daily Gain
	(lb.)	(lb.)	(lb.)	(lb.)
Male singles ..	34·7	0·30	31·0	0·28
Female singles ..	32·5	0·29	28·8	0·25
Male twins	28·4	0·25	29·7	0·24
Female twins ..	27·4	0·23	25·2	0·23

During joining, all rams, both the hand-fed group and those running on native pasture, gained weight.

The results from this joining, together with information extracted from previous joining trials at Toorak Field Station, suggest that the amount of skin folds may exert an appreciable effect on the fertility of sheep in this environment. Further work to investigate this aspect was planned for the autumn of 1960, but as the rainfall on the Station was irregular and very patchy in its distribution, it was not possible to join and lamb without resorting to hand-feeding, which was not considered desirable.

Ram Fertility

Monthly semen samples were collected from the 17 rams which had been studied during the previous year. These rams were bred on the station. They have now been studied over a period of 22 months. Semen samples, obtained by electrical stimulation, have been examined for motility, pH, percentage of abnormal spermatoza, and live and dead staining. There has been much variation in the semen production of rams at most times of the year. In general, semen production has appeared to be of a higher quality during the late summer, autumn and winter, and of lower quality during the drier spring with poor feed. Some rams have, however, continued to produce what appeared to be high quality semen throughout the test period.

As spring joining is practised by many sheep owners in this area, the seasonal variation in semen production is of importance. It is planned to extend this observation in the coming year to include further tests on the semen and to shear the rams in each of two groups twice per year—one group at mid-winter and mid-summer and the other in spring and autumn.

Blowfly Control Trial

As this was a year of low blowfly activity in almost all of Queensland, it is not surprising that a blowfly control trial failed because of the lack of fly strikes. An attempt was made to compare a new insecticide, "Nankor", with diazinon. Altogether 375 unmulesed, uncrutched weaners and hoggets were used. During the first eight weeks of the trial a total of four strikes were found—one in each of the treated groups, both of which failed to establish themselves, and two in the control groups, both of which failed to spread and recovered without treatment.

Pasture and Fodders

The agricultural work is being done in conjunction with the Agriculture Branch and will be reported in greater detail elsewhere. The trials in progress are:

(*a*) *Effect of cutting native pasture at different stages and growth on the botanical composition.*—This trial has shown an alteration in the botanical composition of plots which have been cut and shows that repeated cutting of an area for bush hay would alter the botanical composition of the area.

(*b*) *Sown Pasture—Nursery Plot.*—Attempts are being made to introduce new plants into a nursery plot under normal climatic conditions. Results to date have not indicated any new plants highly suitable to the area.

(*c*) *Fodder Crop Nursery.*—Some fodder crops are already grown in this sheep area. To supplement sheep at periods of poor nutrition, which occur in most years, and during major droughts, that occur not infrequently, a "home-grown" fodder is highly desirable. Since the start of the project seasonal conditions have been below normal in summer rainfall.

(*d*) *Length of Fallow and Row Spacing Trial.*—This long-range trial was established to evaluate the effects of length of fallow and row spacing on yields under the variable climate of the area.

(*e*) *Fodder Production.*—Fifty acres of an 8-months fallow were planted following summer rain in February. Germination was excellent, but the planting was followed by a period of high temperatures and a total lack of rainfall for the ensuing seven weeks and the crop died.

Repeatability

The relationship of a measure of a character in any one year to its value on the same animal in succeeding years is known as repeatability. The measure of repeatability is on a scale of values from 0 to 1. A value of 0 indicates that there is no relationship between the character from one year to the next. A perfect guide from one year's measurement to succeeding years is indicated by the value 1. Values for a number of fleece characters have previously been published. The values obtained from some further characters are as follows:—

Character Measured	Repeatability
Skin fold score (neck)	0·62
Skin fold score (side)	0·50
Body-weight	0·80

Phenotypic Correlations

When characters can be measured it is possible to find out if these characters are related. A strong correlation means it is possible to select by measurement for one character and at the same time have a marked influence on the correlated character. For instance, it is known that greasy fleece weight is a good indication of clean fleece weight, and unless the culling rate is very high, culling on greasy fleece weight is an accurate enough guide. Crimps per inch is, on the other hand, an unreliable indicator of fibre diameter.

Where very accurate results are required, as in ram selection where the culling rate is high, it is necessary to measure each character of interest unless the correlations are very high.

In Table 8 some phenotypic correlations based on 775 sheep are shown. The values again, like repeatability, are measured on a scale on which 1 indicates perfect correlation, 0 indicates no correlation, and less than 0 a negative correlation.

TABLE 8

PHENOTYPIC CORRELATIONS

Character	Skin Fold Score		Body-weight
	Neck	Side	
Greasy Fleece Weight ..	+0·33	0·28	+0·15
Clean Fleece Weight	+0·23	0·20	+0·13
Yield	−0·03	−0·00	+0·02
Staple Length	−0·25	−0·21	+0·05
Fibre Diameter	+0·12	+0·08	+0·11
Crimps per Inch	+0·06	+0·09	+0·00

As it may be necessary to guard against selection for a character which will cause unwanted changes in another character, the correlation between fleece weight and wrinkledness should be noted. The undesirable relationship between fleece weight and wrinkledness is, however, only of moderate intensity. In this case a judicious mixture of selection for fleece weights and culling against folds will not greatly lower the rate of improvement in cut per head, while guarding against any loss of fertility and increased susceptibility to fly strike which may be associated with skin fold development.

CATTLE HUSBANDRY BRANCH

The personnel of the Branch are dispersed at 16 district centres throughout the State where 24 officers are engaged in field work. Other officers are engaged primarily in duties associated with artificial breeding programmes in dairy herds and in special field activity. As there are about 25,000 cattle herds, each extension officer has to serve an average of over 1,000 producers.

Thus, while the visit by an officer to the individual property is probably the most effective means of advising on aspects of production, there are severe physical limits associated with such a method. Field officers, therefore, have been making increasing use of mass media field, such as local papers and radio programmes, and giving attention to providing information to groups at field days, demonstrations, meetings and film evenings. This type of activity lends itself to somewhat more specific advice. For example, considerable success was achieved during the year in teaching the technique of pasture or crop spraying for bloat control. With the co-operation of farmers who had successfully used the technique, group demonstrations plus the provision of written instructions were used to spread the information in the districts where bloat was a serious problem.

Members of the Branch were actively associated with schools for graziers held at Roma and at Magnetic Island, near Townsville. The Roma school was of a public nature while the Townsville school was restricted to 35 participants who devoted four days to an intensive study of problems of production with which they were confronted.

On the Atherton Tableland, officers assisted in staffing a series of Farm Forums each of two days' duration. Four of these forums were held with a total attendance of 75 persons. The forum consisted of lectures, discussions and demonstrations around a central theme.

Recognising the continuous responsibility of an extension organisation to ensure that the knowledge available to its personnel is equal to the situations confronting them, special procedures are undertaken for in-service training. A school for junior Branch officers was held in Brisbane during the year to give advanced training to many of the junior officers. This was the first technical school which these officers had the opportunity of attending. Their response to the two weeks' school was evidence of the value of these gatherings. The technical subject matter embraced the fields of genetics, environmental physiology, growth and development, reproduction and artificial insemination, and nutrition.

BEEF CATTLE INVESTIGATIONS

Investigations into various aspects of beef cattle production were continued during the year at "Brian Pastures" Research Station and on various private properties in association with individual producers.

The beef industry over the past 15 years has experienced marketing conditions which have engendered confidence in the future of the industry. This has been reflected in an interest by producers in those more intensive methods of production which were considered to have no place in the industry only a few years ago. Examples are the exploratory projects undertaken into feed-lot fattening of cattle in 1959, the extension of crop fattening into areas where cultivation had not been practised until recent years, and the interest of some graziers in supplementary feeding of beef cattle in winter to maintain satisfactory growth rate. The co-operation of a number of graziers has made it possible for the Branch to collect data on those more intensive methods of beef production.

"Brian Pastures" Research Station

In co-operation with the Agriculture Branch of the Department, investigations continued at this Station into the factors affecting performance of beef cattle on unimproved pastures, the use of improved pastures for fattening beef cattle, and methods of management of unimproved pastures. Several papers based on the results of work carried out at "Brian Pastures" were submitted for publication in scientific journals.

Reference was made in last year's report to a time-of-calving trial having as its objective an assessment of the influence of season of calving on subsequent growth and development of calves. Early, mid-season and late-calving groups of females are included and five season's breeding performance in the dams and growth in the progeny will be examined. The first year of breeding of the three groups was completed during the year and re-matings were made. The progeny groups are approaching weaning age.

Feed-lot Fattening

The increased value of beef has been responsible for investigations into more intensive systems of production, and notably fattening. Fattening in a feed lot, where the animals are confined in yards and all feed transported to them, is such a method. Grain sorghum supplies were plentiful during 1959 and several producers on the Darling Downs engaged in a feed-lot fattening enterprise as a sideline.

It may be noted that one company has been operating a feed lot in a Brisbane suburb for the past five years. This lot now has a capacity of 1,500 head. The feeding system is based on waste products from fruit canneries and other food factories, together with lucerne hay and a small quantity of protein-rich concentrate. Opportunity for more enterprises using a similar feeding system is limited by the scarcity of such foodstuffs. This particular enterprise is in a position to purchase cheap lines of stock when they become available at Cannon Hill saleyards and this confers an advantage on occasions.

By means of the mobile weighbridge it has been possible to assemble a considerable volume of input-output data which are basic to the planning of an enterprise of this nature. Data of this nature from some feed-lot projects on the Darling Downs are summarised.

Ration.—2 parts grain, 1 part lucerne hay, by weight.

Animals.—78 head of yearling Hereford steers.

Initial weight (lb.)	609
Final weight (lb.)	851
Total gain (lb.)	242
No. of days	98
Average gain/day (lb.)	2.47
Average total feed consumption (lb.)	1911
Average feed consumption/animal/day (lb.)	19.5
Average feed consumption per pound liveweight gain (lb.)	7.90
Est. TDN consumption/animal/day (lb.)	13.65
Est. TDN consumption per pound liveweight gain (lb.)	5.53

Since the projects evaluated during the year were of a sideline nature it was not practicable to cost such items as labour, machinery and depreciation. In all cases the major items in this cost category were already in existence. However, in any well-organised feed lot it can be expected that feed costs would account for not less than 75 per cent. of the total cost. Consideration of feed cost in relation to carcass gain is therefore a major consideration. From the input-output data already quoted for yearling steers these relationships have been established and are presented in Table 1.

TABLE 1

FEED COST IN SHILLINGS PER 100 LB. ESTIMATED CARCASS WEIGHT WITH FEEDSTUFFS AT VARYING PRICES

Grain costs per ton	Lucerne Hay cost per ton			
	£5	£10	£15	£20
£5	58/-	77/-	96/-	115/-
£10	96/-	115/-	135/-	154/-
£15	135/-	154/-	174/-	193/-
£20	174/-	193/-	212/-	231/-

For intermediate figures for lucerne hay increase the cost per 100 lb. carcass by approximately 4s. for every £1 a ton increase in hay price.

In the case of intermediate figures for grain the cost per 100 lb. carcass is increased by nearly 8s. for every £1 per ton increase in grain price.

An important source of revenue in such an enterprise is the appreciation in value of the meat already on the animal at the commencement of the feeding process. This is influenced in two ways. The first is by buying stores at a lower rate per 100 lb. and the second is by selling fats on a premium market. There is no specific premium market for lot-fattened steers at present but there is a premium market in relation to season, as beef prices are normally highest during the last quarter of the year.

Expansion of fattening methods by the use of the feed lot is closely associated with the relationship between meat and grain prices. Conditions at the close of the year under review were not favourable to feed-lot fattening. Grain prices had tended to harden and the store price of suitable cattle was very high in relation to fat price.

Since the cost of transport is a major factor in enterprises of this nature it appears that development should occur in those districts where the bulk of the fodder is grown and where suitable cattle are available. It is considerably cheaper to transport the product of one ton of fodder in the form of a steer than in its original form. Taking Miles as a centre, for example, the cost of transporting one ton of grain in truck lots to Pinkenba is £4 5s. 10d. One ton of feed (grain and hay) is ample to fatten a steer with a dressed weight of approximately 500 lb. The cost of transporting such an animal from Miles to Cannon Hill in truck lots is approximately £2, that is, less than half the cost of transporting the fodder.

Data obtained during the year suggest that the American feeding standards for beef cattle can be used with a reasonable degree of confidence. Rate of gain and feed consumption can be estimated to a satisfactory degree when the ration constituents are reasonably stable in foodstuff value.

Growing plant material can form a portion of the ration but its feeding value at different stages is difficult to assess. With approaching maturity there is a rise in fibre, a drop in digestible protein content and a lowering in the digestibility of the whole plant.

An attempt to utilize surplus sugar cane for fattening cattle showed that mature sugar cane was very fibrous and the "trash" created difficulties in harvesting. This attempt suggests that mature sugar cane in plant form is unsuitable as a basis for a ration for fattening cattle.

Crop Fattening

The results obtained in many field studies with cattle are influenced markedly by the climatic conditions prevailing at the time, thus necessitating a repetition of the procedures and observations over several years. This is the case with a programme involving study of the economics of crop fattening. In addition, the income derived from an appreciation in value of beef during the period animals are on crop plays an important part in determining the profitability of the enterprise. These variable factors showed up clearly in the 1959 studies, when crop yields were lower and the appreciation in carcass value was less than observed in 1958.

The 1959 investigation was again a co-operative effort with the Commonwealth Bureau of Agricultural Economics and followed similar lines to the previous year. Properties in the Central Highlands district were included on this occasion.

Owing to the relative shortage and high price of store cattle early in 1959 some fatteners found difficulty in obtaining suitable stock. Where this circumstance was combined with a poor crop yield the revenue per acre was negative. The net additional grazing income per acre, which is the amount over and above all costs, ranged from —£4.61 (where the crop was a failure and no grazing was obtained) to £26.10, with an average of £5.78.

A summary comparison of key aspects for each year is as follows:—

—	1958–59	1959–60
Liveweight gain per acre	209 lb.	164 lb.
Store price per 100 lb. carcass	£6·15	£8·99
Fat price per 100 lb. carcass	£7·31	£9·68
Difference Fat price less Store price per 100 lb. carcass	£1·61	£0·69
Average total costs of fattening per acre	£4·15	£3·57
Average total net grazing income from crop per acre	£11·33	£5·78

Supplementary Feeding

Ill-thrift in weaner and yearling cattle is a factor of considerable importance when increasing emphasis is being placed on turn-off at a younger age. Weaning normally occurs during winter or early spring when native pastures are at a low level of productivity and low in food value.

This ill-thrift, which has been defined in studies at several centres and notably at "Brian Pastures," can be approached from both the managerial and the nutritional angles.

The weaning of calves usually results in some slight setback to the calf. This can be expected even if the plane of nutrition is improved after weaning and it is attributed to the psychological effect of the removal of the dam. Under favourable conditions recovery should be effected in two weeks and from that time the calf's performance is a reflection of the plane of nutrition and standard of husbandry.

In order to maintain an acceptable growth rate after weaning it is evident that some form of supplementation of native pastures is required. This can take the form of improved pastures, either rain-grown or irrigated, or a suitable annual or perennial crop where such measures are practicable. However, there are large areas of land used for the breeding of beef cattle where the provision of a feed supplement which has been stored or purchased is perhaps a more suitable approach to the problem. The object in providing such a supplement is to increase the value of the basic ration, through either appetite stimulation or an improvement in digestibility. It is considered that the twin factors of maintenance of fodder intake and relative indigestibility of mature grass impose limits on the performance of the animals as distinct from the quantity of fodder which is available to them. Thus the value of a supplement does not necessarily rest entirely on its intrinsic fodder content but also on its effect on animal appetite and the digestibility of other material. For example, there is some evidence to suggest that high-energy supplements such as grains are used by grazing animals to some extent as substitutes for the basic ration. On the other hand, the response to small quantities of lucerne hay or high-protein meal indicates that an additive effect is operating.

According to American feeding standards the total digestible nutrient requirements (TDN) per lb. liveweight gain is 2-2.5 lb. for yearling steers and 2.5-3.2 for 2-year-old steers of the type used in the field trials.

The field trials conducted to date are summarised in Table 2. The first two were conducted in 1958 and the last five in 1959. They extended from late autumn or early winter until favourable pastoral conditions occurred in spring. The ration is the quantity of foodstuff additional to grazing offered to each animal on a daily basis, whereas actual feeding was done twice-weekly. The column headed "Response" refers to the weight performance of the fed animals over the control groups which received no supplement. On two occasions several supplements were tested simultaneously against the one standard unsupplemented group.

In considering the trials involving the use of bush hay, it is pointed out that the TDN value given to this material is very high in relation to its net energy value. Further, the hay was not always readily eaten and wastage was of a high order. It would appear that the bush hay, which is made from native pasturage, is little superior in feeding value to the standing pasture available at the time of supplementation later in the year. The hay served a useful purpose in reducing the risk in the feeding of urea.

TABLE 2

SUMMARY OF FIELD TRIALS ON SUPPLEMENTARY FEEDING

District and Year	Type of Animals	Duration of Feeding (days)	Response (lb. live-weight)	Daily Ration	Total Feed Consumption: Foodstuff (lb.)	Total Feed Consumption: Estimated TDN Intake (lb.)	Total Feed Consumption: Estimated Digestible Protein Intake (lb.)	Pounds TDN Required per lb. Live-weight Difference	Pounds Digestible Protein Required per lb. Live-weight Difference
Emerald (1958)	Yearling steers	113	+34	3 lb. grain sorghum ..	339	271	27·0	8·0	0·8
Rockhampton 1958)	Yearling steers	101	(a) +71	2 lb. lucerne hay	202	101	20·0	1·4	0·3
			(b) +38	2 lb. bush hay	202	..	..	..	..
				1 lb. molasses	101	172	15·6	4·5	0·4
				1 oz. urea	6·3	..	..	..	..
Rockhampton (1959)	Yearling steers	195	(a) +98	3 lb. lucerne hay	585	292	58·5	3·0	0·6
			(b) +62	1 lb. molasses	195	117	91·0	1·9	1·5
				3 oz. urea					
Emerald (1959)	Yearling steers	188	+52	1 lb. cottonseed meal ..	188	141	63·0	2·7	1·2
Springsure (1959)	Yearling steers	112	+74	1 lb. cottonseed meal ..	112	173	46·0	2·3	0·6
				1 lb. grain sorghum ..					
Eidsvold (1959)	Yearling steers	161	+85	1 lb. cottonseed meal for first 50 days; thereafter 2 lb. cottonseed meal ..	272	204	91·0	2·4	1·1
Clermont (1959)	2-year-old steers	201	+17	5 lb. bush hay	1,005	680	95·0	40·0	5·6
				1 lb. molasses	201				
				3 oz. urea	38				

From the available evidence, small quantities of lucerne hay or high-protein meal appear the most efficient under the conditions of the trials. Factors which considerably influence the efficiency of supplementation are the length of the feeding period and the nature of the basic ration. Supplementation for periods from 161 to 201 days produced no greater differences than a feeding period of between 90 and 120 days. Increasing the quantity of lucerne hay from 2 lb. to 3 lb. a day did not produce a greater weight difference and it is evident that the optimum level of supplementation is not yet known.

However, the field trials completed on this subject to date have provided a great deal of information which can be used to avoid serious errors and losses when this type of feeding is practised.

Observations on the response to supplementary feeding have been continued to include residual effects. The factor of compensatory gain has been operating to a varying degree. This illustrates the fact that animals transferred from a low plane of nutrition to a high plane make greater gains for a short period than animals maintained on an even nutritional plane. This consideration is of importance to producers in making decisions concerning supplementary feeding as a means of preventing weight loss. The evidence shows that compensatory gains do reduce the advantage obtained from the supplement under known conditions. On that account the economics of the practice operate against supplementation as a means of preventing weight loss. However, when supplementation has the effect of preventing deaths there is little doubt of its economic value. At the beginning of winter, when the growth of young animals on native pastures comes to a standstill, it is not possible for the producer to forecast whether supplementary feed will be needed for the survival of his animals 4-6 months hence. Under present price conditions, the grazier is well advised to store some type of fodder in order to ensure animal survival.

The post-feeding performance of four groups of animals appearing in Table 2 is shown in Table 3.

Copper Deficiency in Cattle

Copper deficiency in cattle has been reported from many parts of Queensland over the past 10 years. The condition has been diagnosed on the evidence of low levels of copper in samples of liver or blood of cattle. However, copper therapy has not always resulted in improved growth rate or milk production in cattle on properties where the condition has been diagnosed.

During the year two trials were initiated to study the response to copper therapy and to combined copper-cobalt therapy in cattle on properties on which cattle are believed to be copper-deficient on the basis of liver copper analyses. Both properties are situated on low-lying coastal plain country, one in the Townsville district and the other in the Rockhampton district.

Beef Cattle Breeding Station, Millaroo

During the year a property approximately 30 square miles in area at Millaroo in the Burdekin basin was acquired for development as a beef cattle breeding research station. The property comprises country representative of an extensive area of country in the hinterland of North Queensland which is used for breeding beef cattle. The major projects to be undertaken are a critical study of the performance of cattle of different breeds in that environment and an examination of the effects of different management practices on growth rate and other criteria of performance.

DAIRY HUSBANDRY

Dairy Cattle Breeding

During the year the decision was taken to commence long-range studies in breeding of dairy cattle for tropical conditions at the former Regional Experiment Station

TABLE 3

RESIDUAL EFFECTS OF SUPPLEMENTARY FEEDING

Location	Liveweight Difference at End of Feeding Period (lb.)	Date of End of Supplementary Feeding	Date of Post-Feeding Weighing	Difference at Post-Feeding Weighing (lb.)	Post-Feeding Nutrition
Rockhampton (1959)	(a) 98 (b) 62	12–11–59	13–1–60	(a) 86 (b) 61	Native pastures
Emerald (1959)	52	10–11–59	14–1–60	24	Native pasture and grazing crop
Springsure (1959)	74	5–11–59	28–1–60	38	Feed-lot fattening
Eidsvold (1959)	85	21–10–59	24–2–60	75	Native pastures and grazing crop

at Ayr. The programme initiated involves the cross-breeding of animals of three dairy breeds of European origin—Friesian, Australian Illawarra Shorthorn and Jersey—with animals of the Sahiwal breed, which is one of the most promising of the Indian breeds of dairy cattle.

A number of animals of the Sahiwal and Red Sindhi breeds were imported into Australia from Pakistan by the Commonwealth Scientific and Industrial Research Organization in 1953. Several years ago that Organization made available to this Department a small number of animals of both breeds. With the facilities available for dairy cattle crossbreeding work it has been deemed advisable to use only the Sahiwal breed in the Department's programme. Studies involving the Red Sindhi breed are being undertaken by the staff of the Queensland Agricultural High School and College.

The European breeds of dairy cattle are recognised as having the potential for very high levels of dairy production under favourable conditions. However, they are generally unable to attain their full potential for high production under tropical or subtropical conditions. The Indian dairy breeds such as the Sahiwal have not the same potential for high production as the European breeds but they are better adapted to tropical and subtropical conditions. The objective of the breeding programme initiated at Ayr is to develop a strain of cattle with the optimum combination of the productive capacity of the European breeds and the adaptability of the Sahiwal.

The development of the programme will involve certain re-design of the property facilities to handle experimentally a large population of dairy cattle. Additional capital works for the execution of the programme will also be required.

Persistency of Lactation

The amount of milk produced by a cow in a lactation is dependent on two factors, the peak level of production attained in early lactation and the persistency with which production is maintained. In a normal lactation of a well-fed cow production rises by about 20 per cent. from the level immediately after calving to a peak at about 3-5 weeks following calving. Thereafter, production declines on the average by about 8-10 per cent. per month from the peak production. This normal lactation curve is maintained only if the cow is fed at adequate levels throughout the lactation. If feeding at any stage of lactation is markedly below the animal's requirements production will decline below the level predicted from the lactation curve. Under Queensland conditions, where cows are dependent in many cases on grazing alone for their feed supply, the lactation curve can depart very markedly from the normal. A study of the lactation curve of cows in herds of low production is often of assistance in planning measures to improve production.

In Table 4 data are presented on the lactation curves of cows in the herds at the Regional Experiment Stations at Biloela and Kairi. The data for each herd are presented as averages for all cows which completed a lactation in the years specified. As there was a spread of calving in each herd over approximately six months the figures cannot be taken to indicate a definite seasonal influence.

The data do indicate that in the case of the herds at Biloela, and particularly No. 1 herd, lack of persistency is a major factor limiting production. The strategic use of conserved fodders to arrest decline in production in the first four months of lactation is indicated. Preliminary trials on feeding of concentrates in this period suggest that a marked increase in production can be expected.

In the Kairi herd an excellent level of persistency is obtained in early lactation but production drops sharply at the seventh month. This is almost certainly associated with decline in feed value in late autumn, and some form of improved feeding at this stage should be profitable.

Feeding Concentrates for Milk Production

With an increase in the proportion of Queensland's dairy output which is being used for the liquid milk market and the increase in grain-growing throughout the State, the feeding of concentrates to dairy cows is likely to assume greater importance. Producers selling wholemilk are more likely to feed concentrates than those supplying butterfat for manufacture, as they receive a higher price for their product and also have to maintain output at a more or less constant level throughout the year.

A trial is in progress at Kairi Regional Experiment Station to study the effect of concentrate feeding throughout the cow's productive life, commencing just before first calving. Concentrates are fed to one group of cows for a period of six weeks before expected calving date and throughout the lactation at the rate of 2½ lb. per gal. of milk produced. The concentrate mixture fed comprises one part meatmeal to three parts cracked grain. A group of cows are maintained for comparison under conditions identical except for feeding of concentrates. The results of the first two years' lactations are shown in Table 5.

In the first lactation the increase in production represents 1.445 lb. extra milk per lb. of concentrates fed, and in the second lactation 1.714 lb. extra milk per lb. of concentrates. These figures represent satisfactory rates of conversion of added feed into milk in comparison with results of similar experiments overseas. This may be attributable to the fact that efficiency of conversion of feed into milk is generally higher at low levels of production than at higher levels. The basic level of feeding in this trial is certainly much lower than that of most feeding trials of a similar type reported overseas.

The following features of the performance of the cows in the experiment to date are of interest:—

(1) At the commencement of first lactation, level of production of the fed group was only slightly higher than that of the control group. This small difference is believed to be due to pre-calving feeding.

TABLE 4

LACTATION CURVES IN HERDS ON REGIONAL EXPERIMENT STATIONS

Months after Calving	Kairi Regional Experiment Station (130 cows)			Biloela Regional Experiment Station					
				No. 2 Herd† (32 cows)			No. 1 Herd* (42 cows)		
	Daily Milk Production (lb.)	Change		Daily Milk Production (lb.)	Change		Daily Milk Production (lb.)	Change	
		lb.	%		lb.	%		lb.	%
1	24·16	..	..	26·17	..	..	22·39	..	..
2	28·70	+4·54	+18·7	32·14	+5·97	+22·7	27·57	+5·18	+23·2
3	28·96	+0·26	+ 0·9	29·36	−2·78	− 9·5	22·48	−5·09	−18·5
4	26·89	−2·07	− 7·2	26·60	−2·96	−10·1	18·28	−4·20	−18·7
5	24·66	−2·23	− 8·3	22·44	−4·16	−15·6	15·49	−2·79	−15·4
6	22·89	−1·77	− 7·2	20·01	−2·43	−10·7	13·87	−1·62	−10·5
7	16·79	−6·10	−25·9	16·88	−3·13	−15·7	12·41	−1·46	−10·5
8	11·75	−5·04	−30·1	14·43	−2·45	−14·5	11·25	−1·16	− 9·3

* No. 1 herd grazed mainly on rain-grown pastures and crops and supplemented with silage.
† No. 2 herd grazed mainly on irrigated pastures.

TABLE 5

RESULTS OF CONCENTRATE FEEDING

—	No. of Cows	Average Milk Production (lb.)	Average Butterfat Production (lb.)	Average Length of Lactation (days)	Average Amount of Concentrate Fed (lb.)
			1957/58		
Concentrate-fed group	8	4,892	198	221	1,345
Control group	8	2,948	120	179	..
Difference	..	1,944	78	42	1,345
			1958/59		
Concentrate-fed group	11	4,806	185	225	1,255
Control group	11	2,606	101	173	..
Difference	..	2,200	84	52	1,255

(2) The fed group showed a greater rise after calving to peak production than the control group, peak production was attained later and persistency of production was greater.

(3) There was a more marked difference in initial level of production between the groups at the commencement of the second lactation but otherwise differences between groups were similar to those seen in the first lactation.

Proving Dairy Bulls

Programmes were continued at Nambour and Kingaroy for the Jersey and A.I.S. breeds during the year. The field methods and procedures remained unchanged from those reported for previous years. The breeding season at each centre commenced on Sept. 22 and proceeded until mid-January. At Nambour, a total of 2,550 inseminations was made, while at Kingaroy the number was 2,334.

During the year under review 98 daughters of the Jersey bulls used in the 1955 season completed lactations in the recorded herds of co-operative farmers. It is performance of daughters under conditions of commercial production that is the basis of all methods of sire evaluation. The sundry methods that have been suggested differ only in technique of data treatment analysis. The production figures available during the year from the daughters and from other heifers in those herds formed the basis for an evaluation of the relative merit of the 1955 Jersey bull team. The ranking of the four bulls used in 1955 was unchanged when a variety of analysis techniques was applied to the production data.

The relative ranking of the four bulls used in 1955 is presented:—

Bull A	+7 lb. butterfat
Bull B	−9 lb. butterfat
Bull C	+2 lb. butterfat
Bull D	−12 lb. butterfat

Breeding Survey and Infertility Investigations

The survey of breeding records of approximately 150 dairy herds reported in previous annual reports is continuing. Some of the results of the survey have been reported in an article in the *Queensland Agricultural Journal* and several scientific papers are being prepared for publication.

It is generally agreed that regular calving of cows at intervals of 12 months is desirable in dairy herds if maximum production is to be attained. Data on the incidence of calving intervals longer than 12 months provide an indication of the extent to which reproductive disorders are limiting production.

In Table 6 data on the incidence of calving intervals of various lengths obtained in the herd breeding survey are presented.

TABLE 6

DISTRIBUTION OF CALVING INTERVALS

Interval Length (days)	Percentage of Records of Specified Length
Less than 300	1.28
301-330	23.07
331-360	22.97
361-390	20.16
391-420	12.57
421-450	6.41
451-480	4.37
481-510	2.40
511-540	1.91
Over 540 days	4.84

(Data on 6,820 records from normal calving to normal calving).

In the survey, it was found that the incidence of prolonged calving intervals was much higher in herds in the Moreton district than in herds in other districts. This is illustrated in Table 7.

TABLE 7

LENGTH OF CALVING INTERVAL

District	Percentage of Calving Intervals exceeding 390 days
Atherton Tableland	26.2
Central Coast	24.3
North Burnett	17.3
South Burnett	23.2
Darling Downs	23.3
Moreton (Coast)	37.5
West Moreton	33.3
State	31.7

Analysis of the data indicates that in 28 per cent. of the cases where the calving interval was longer than 390 days calving was deliberately delayed as a management practice. In 32 per cent. of cases anoestrus following calving was associated with prolonged calving intervals, and in 34 per cent. of cases there was regular return to service without conception.

PIG SECTION

Changes in availability and price of various foodstuffs yielded a somewhat different pattern of feeding than in the previous year.

Dry conditions early in 1960 caused many farmers to revert from a skim-milk surplus to an insufficiency for full protein requirements. Dried buttermilk fell off in supply also as dairy production decreased.

Wheat was priced beyond the reach of pig raisers, but appreciable amounts were fed on the Darling Downs following damage by hail and storms during harvesting. A good deal of rain-damaged barley grain was also available from the Downs. Sorghum supplies were adequate. Reports from sorghum users indicate that some varieties may be more palatable to pigs than others, and a palatability trial is planned by the Section.

Though millets and canary seed were not available in the same quantities as in the previous year, these grains were used by a number of producers. Reports from bacon factories of soft, oily fat were investigated and over-feeding of these grains was held to be responsible in some cases. Trials terminating in the winter of 1959 indicated that up to 30 per cent. of these grains could be fed in a ration without causing oily fat or breakdown of fat on cooking.

Meat-and-bone meals were of variable quality, and those with a large proportion of bone had a low true digestible protein level. Because of the high calcium content of such meals a number of cases of parakeratosis were reported when the meal was fed at the recommended levels to pigs running on the lime-rich soils of the Darling Downs and the Central Queensland areas. Addition of zinc to the feed cured the complaint in most cases.

Figures from meatworks and bacon factories indicate a slight increase of pigs slaughtered over the previous year. The number of live pigs sold for slaughter in New South Wales was again an appreciable figure, while southern States again drew on Queensland for supplies of finished and green bacon.

North Queensland production decreased, but production in Central Queensland again increased. The Callide-Dawson Co-operative Bacon Factory is not yet completed.

Quality of carcasses appeared to be better than during the previous year. There were complaints regarding pigs from several centres having oily fat or yellow fat. Most of these when investigated were found to be due to feeding excess peanuts, canary seed and millet, or a too liberal grazing regime.

The increases in breeding stock reported during the first half of the year have been offset by disposals due to dry weather and lack of feed in the second half.

DISEASE

Due to the mild winter and spring, losses from disease were lower than normal. Leptospirosis and post-parturient fevers caused most trouble in the North, with minor losses from Glasser's disease, pneumonia, scours in suckers and scrub ticks. Brucellosis was prevalent in two large Cairns piggeries.

Leptospirosis was reported as widespread in all districts, causing upsets to breeding programmes as well as losses of litters. Brucellosis cases were not numerous in central and southern districts, due primarily to the Brucellosis-tested Herd Scheme for stud breeders.

Virus pneumonia-like conditions were common throughout the districts, but other pneumonic complaints were not as prevalent as in the previous year. An attempt is being made on the Downs to establish a herd free from virus pneumonia.

Scours in sucking pigs were reported from all districts, and not solely from farms with poor housing and hygiene. Iron deficiency was responsible for portion of these cases only.

Agalactia cases continue to occur in all areas from a variety of causes. A feature in the late summer was the number presumed caused by a heatwave.

Parakeratosis was reported on a number of farms in the Downs and Central Queensland districts. This could become a seasonal disease in winter and spring, on the lime-rich soils, as during this period meat-and-bone meals with a high level of calcium are fed in place of separated milk.

Photosensitivity was prevalent in the Warwick area amongst white pigs. This condition was regarded as possibly responsible for some abortions.

Some cases of paralysis in the Brisbane Valley responded to the addition of copper to the ration.

Treatment for worm control appeared to be a more common practice amongst farmers.

Sarcoptic mange continues to be largely a seasonal (winter-spring) complaint, but was not as prevalent generally as in the previous year.

The Brucellosis-tested Herd Scheme was continued, and the number of breeders participating was increased due to the entry of Landrace breeders.

RESEARCH

At Hermitage Regional Experiment Station, three experimental pens fitted for individual feeding of five pigs each were completed. A feed-shed and an office building were erected, and three new farrowing and rearing pens added. Individual sow feeding stalls for 12 sows were also provided. All farrowing pens were fitted with creep, hover boards, and low false ceilings.

Additional farrowing and experimental pens were erected at Biloela Regional Experiment Station, and stalls for individual feeding of sows built. Farrowing pens were fitted with creeps and hover boards.

At Kairi Regional Experiment Station, feeding stalls for the sows were built, and new drainage lines provided. Farrowing pens were also fitted with creeps and hover boards.

At all Stations, sow performance trials were commenced, with a different plane of nutrition at each centre. This long-term project should provide basic information on feeding and performance of breeding sows. What appeared to be a vitamin A deficiency developed in the sows, and vitamin A will be added to the rations fed.

Coupled with the sow studies are others on litter rearing with creep feeding. At Hermitage, where this work originated, provision of creep feed and water in a creep inside the shed, and the fitting of hover board and false ceiling in cold weather, have increased weaning weight averages by over 10 lb. per pig. Litters averaged up to 55 lb. per pig at weaning. The studies are providing information on the habits and growth of piglets, and have been extended to the other two Stations. Heavy-weight Berkshire weaners from these trials were marketed at 19 weeks of age weighing up to 130 lb. dressed. Rations were restricted to a maximum of 5 lb. of concentrates per day.

Feeding trials with pigs fed individually indicated a steady rate of gain in contrast to group-fed pigs, whose rates of gain varied considerably.

Trials to test the palatability of different peanut meals were run. The pigs preferred the meal without excess fibre added in the crushing process. When the pigs were fed peanut meal in a ration up to slaughter time, factory reports advised only a slight softness of the pigs' fat on chilling.

At Biloela, investigations were made into palatability of various grains. The pigs preferred a grain they had been accustomed to for a while after change of feeds. The order of preference was wheat, sorghum, and maize.

Oats grazing trials did not give any indication that savings in concentrates were made by pigs grazing on the oats on this occasion. Hogging-down of maize and sweet sorghum was practised.

A hogging-down trial was conducted at Kairi Regional Station. Four groups of pigs were allowed to hog-down maize, one on free-range basis, one under strip-grazing conditions, one strip-grazing of maize plus green panic grass, and one strip-grazing of maize plus green panic plus arrowroot. A fifth group was fed a balanced ration to appetite in pens.

No conclusive results were obtained, but the penned group were all overfat and third grade on slaughter. The grazing groups were graded 13 first, 8 second, and 11 third grade. In these groups the lengthy-type pigs graded first while short, thick-set types were graded lower.

PIG TESTING STATION

The first breeder's group of four pigs arrived at the Rocklea Testing Station on April 14, 1959, and other groups followed at short intervals. After some time appearance and growth rates of pigs were revealed as unsatisfactory. Investigations showed that one of the

PIG RESEARCH FACILITIES

Plate 43.—Experimental pens fitted for individual feeding, Hermitage Regional Experiment Station.

Plate 44.—Farrowing and rearing pens, Hermitage Regional Experiment Station.

Plate 45.—Windbreak of athel trees and Arizona cypress on western side of piggery at Hermitage Regional Experiment Station.

foodstuffs did not reach the standards originally set, due to chemical variation. The Advisory Committee appointed to supervise the operation of the Station compiled a new ration, using foodstuffs not likely to vary widely in manufacture. The second lot of pigs, tested on the revised ration, have shown growth rates and appearance superior to the first groups on the old ration.

Seventy-two pigs completed the test in the first groups. While the records of these pigs provided useful information, they cannot be regarded as a true indication of the worth of the boars whose progeny was tested.

It was not always possible to deliver all pigs to the factory at exactly 200 lb. liveweight and a weight correction scale was used to bring results to a common mark of 200 lb.

The first group of pigs to be tested on the new ration reached the Station on Mar. 4, 1960, and subsequent arrivals have occupied most of the pens. With the more satisfactory growth rates, pigs were starting to reach the 200 lb. weight about the end of June.

COMMONWEALTH EXTENSION SERVICES GRANT

Projects in the Mundubbera area were left without adequate supervision during the year, due to the resignation of the advisory officer for the area. Some supervision was effected by the Pig Section officer from the neighbouring district. The sale of one farm caused the project thereon to be discontinued. It is hoped that an officer will be available for this area later in 1960.

In the Moreton area seven demonstration farms continued to operate under the full-time supervision of the officer appointed for this district. Regular visits were made to each farm at intervals of approximately three weeks. All farmers have co-operated willingly in the various projects, and have made improvements to the facilities at their own expense.

There were a number of changes in the types of demonstrations to bring them more into line with local requirements. Change of activities, where effected, was done gradually. New investigational work was very limited owing to restricted financial aid. Funds available were used principally for maintenance.

On the farms where litter recording was initiated, visits were more frequent until the work was well established. Two of these farms are making good use of results to select improved replacement sows. In one herd over 50 per cent. of the sows have thus been replaced by gilts reared within the herd, and from prolific, good-mothering strains. Greater selection of pigs for improved type has been made on all farms.

Grazing demonstrations have not proved effective on the farms for which they were originally planned, due to the type of country involved. Central feeding floors were constructed on two of these farms to permit control of stock and feeding during excessively wet or very dry weather.

Deep litter trials were not pressed due to the labour involved to work the pens as constructed. A short trial was conducted to test this system for garbage-fed pigs, and proved only reasonably satisfactory.

A Field Day on pig husbandry subjects, held on a Kilcoy demonstration farm, was well attended, and created additional interest in pig-raising in the area.

The demonstration farms operated satisfactorily during the year and are proving their worth in the surrounding localities. Success of these demonstrations appears to lie in the fact that Government funds help to prove the effectiveness of principles demonstrated before farmers need outlay funds to make changes.

GENERAL

The comparative prosperity of those engaged in pig-raising has been stressed by the increased interest in better stock, housing and management. Considerable building of new accommodation and equipment was reported from all districts. Demand for good quality breeding stock continued throughout the year, and a number of breeders were unable to meet demands.

The Landrace breed has spread throughout the pig-raising areas of the State. Unfortunately, many sales of poor-type animals were made; in addition, crossbred Landrace boars were sold as well as sows. This type of stock has already resulted in dissatisfaction, and could well bring the breed into disrepute.

The litter recording scheme operated in most districts during the year. In some cases farmers stopped recording when they saw that they were obtaining poor results. Several of these men realised that better housing was needed for their sows and litters. Farmers generally will continue with the scheme if a Pig Section officer does all the weighings, but discontinue if left to do weighings themselves.

There was a continued heavy demand for the services of district officers. In some districts it was impossible to meet all demands for their services, and additional staff would be required in these areas to satisfy requests for information.

Wireless broadcasts, press items, movie films, Field Days, demonstrations, meetings and discussion groups were all used by Section officers in their extension work. In addition, the Senior Adviser for Moreton district was a guest lecturer to a Rotary School for migrant farmers at the Queensland Agricultural High School and College, as well as being an examiner in practical pig husbandry for the Gatton Diploma examination.

A meeting of the Technical Sub-Committee on Pig Production held in Sydney during March 1960 was attended by the Senior Husbandry Officer.

POULTRY SECTION

POULTRY SLAUGHTERING

During the year, regulations concerning the licensing of poultry slaughtering houses, the compilation of monthly returns, and the collection of inspection fees were gazetted. At the same time, action was taken to amend existing regulations dealing with the construction and hygiene of poultry slaughter-houses.

Licensing of slaughter-houses began in March. To date, 20 licenses and 64 provisional licenses have been issued. The provisional license is issued for a "grace" period of three months; only under exceptional and very extenuating circumstances will a further provisional license for a like period be granted.

Licensed and provisionally licensed poultry slaughter-houses are now operating under Departmental supervision in Brisbane, Redcliffe, Gold Coast, Toowoomba, Warwick, Dalby, North Coast, Maryborough, Bundaberg, Rockhampton, Sarina, Mackay, Townsville, Cairns and Atherton.

Table 1 sets out the total number of poultry slaughtered in the Brisbane-Gold Coast area.

TABLE 1

POULTRY SLAUGHTERINGS AT ABATTOIRS IN THE BRISBANE-GOLD COAST AREA, 1955-56 TO 1959-60

Year	Cockerels (Broilers)	Hens	Total slaughtered (including ducks, turkeys, &c.)
1955–56 ..	316,991	381,561	512,438
1956–57 ..	348,922	400,105	734,952
1957–58 ..	362,713	377,105	779,090
1958–59 ..	552,794	345,992	928,654
1959–60* ..	829,946	384,443	1,248,964

* Estimated figures.

DAY-OLD CHICK PRODUCTION

The number of chickens sexed in 1959 was 4,204,278, which was 40 per cent. greater than the number sexed in the previous year. A considerable number of the pullets were sent interstate or exported to New Guinea. The cockerel chickens, particularly crossbred and Australorps, found a ready market with broiler growers. The demand for continuity of supply of day-old chicks for broiler growers has meant that a number of hatcheries now operate throughout the year.

REGISTRATION OF STOCK SUPPLIERS

During the year 13 stock suppliers engaged in the business of hatching day-old chickens for sale, eight stock suppliers supplied fowl eggs for hatching and three poultry dealers did not renew their registrations. However, 17 new registrations were effected, six for hatching chickens for sale, two for the supply of fowl eggs for hatching, and nine poultry dealers. The number of stock suppliers now registered is 182.

POULTRY ADVISORY BOARD

This Board met on three occasions. The business dealt with included the amount of precept to be levied on Marketing Boards; consideration of proposals for marking and grading of eggs and licensing of poultry slaughter-houses; the introduction of a pullorum testing accreditation scheme; and the programme of experimental work to be conducted by the Poultry Section.

The term of the present Advisory Board ended on June 30, 1960, and nominations were called for from the Egg Marketing Boards and the Egg Marketing Board Suppliers' Organisation for representation on the Poultry Advisory Board to be constituted as from July 1, 1960. In respect of the nomination from the Egg Marketing Board Suppliers' Organisation, it is fitting to record that this was done at the suggestion of the executive of the National Utility Poultry Breeders' Association, who considered that organisation the body now more truly representative of the industry.

QUEENSLAND POULTRY IMPROVEMENT PLAN

Twelve well-established poultry breeders are co-operating with this Section in the Queensland Poultry Improvement Plan. Nine of the breeders have now been co-operating since 1957, and three since 1958. All are intensely interested in this work. Some have realised that their original testing facilities were not sufficiently great to meet the needs of a developing breeding scheme and four breeders have doubled the number of their progeny testing pens. Two breeders are now using laying cages for single-bird recording in addition to recording on a family basis in progeny testing pens.

Regular visits were made by staff to all breeding farms to give assistance in the collation of data and guidance in the application of records for planning matings. It is pleasing to report that the general improvement in average production per bird in the breeding nucleus on a number of farms and better liveability has been reflected to some degree in the better results obtained in the second random sample test completed in December 1959 and in the progress results of the current test.

RANDOM SAMPLE TESTING

The average results obtained in the 1958-59 random sample test—the second to be held in conjunction with the Queensland Poultry Improvement Plan—were considerably better than in the previous year. Hen-housed production per bird was 171.52, compared with 160.83 for the previous test, and hen-housed mortality showed a decided improvement, 8.75 per cent., compared with 12.31 per cent. (1957-58 test).

As in the previous year and under the terms of the Plan, the results for certain economic factors were used for the purpose of granting approval on probation. Of the 13 breeder entrants, three met the requirements for this probationary approval. The total number accorded this probationary approval since the inception of the Plan is now five.

Losses due to disease were low during the laying period of the test, and over half of those recorded were due to various forms of the avian leucosis complex.

The purchase of a fully automatic calculating machine from Commonwealth Extension Service Grant funds has facilitated the compilation of results, which are now provided at regular intervals to all entrants.

The third Random Sample Test commenced on January 13, 1960. Table 2 sets out data so far available for this current test as compared with the previous tests.

TABLE 2

COMPARATIVE DATA—RANDOM SAMPLE TESTS, 1, 2, AND 3

Test	Hatchability (%)	Mortality to 10 Weeks (%)	Mortality to 18 Weeks (%)	Age at First Egg (days)	Age to Reach 50% Production (days)
1 (1957–58)	75·36	4·72	2·12	153	192
2 (1958–59)	72·22	2·18	·41	144	170
3 (1959–60)	74·10	1·29	·27	138	166

Apart from hatchability, which has not varied greatly, there has been a progressive reduction in mortality rates to 18 weeks of age. Sexual maturity (as indicated by age at first egg) is occurring at an earlier age, and this is reflected in the age at which pullets reach 50 per cent. production, at which level income from eggs should begin to show a margin of profit over feed costs. However, the age of sexual maturity has to be watched closely, as the volume of small "pullet" eggs may affect the level of profitability. "Pullet" eggs (under 1¼ oz.) are valued at less than half "small" hen eggs (over 1½ oz. but under 1⅞ oz.).

EXTENSION WORK

General

During the year under review considerable emphasis was placed on the maintenance of egg quality, the use of high-energy rations, and the need for types of housing more suitable climatically to Queensland. The wider use of mass media such as newspaper articles and radio talks on these subjects elicited a very satisfactory response for further information by producers. It is becoming increasingly apparent that a more flexible approach in the type of advice and in the manner in which it is given is necessary, for producers may be divided broadly into two classes—(1) the established farmer who wishes to make improvements, and (2) the newcomer to the industry who has little basic knowledge of poultry management and disease control.

A forward step was taken in regard to the second group when the decision was taken to conduct a school for poultry farmers in the Wowan district, as many of the people there had had very little experience in commercial egg production. The response was good and those who attended proved a very eager and receptive audience. The school was held in September on three consecutive days, in which time a good coverage was made of the main aspects of husbandry. The participation of the Veterinary Services Branch in discussions of important poultry diseases was greatly appreciated by producers.

In co-operation with the Redlands Poultry Association, a Field Day was held on Mr. A. A. Benfer's large broiler and laying cage farm at Mt. Cotton. Despite bad weather conditions, nearly 400 people attended from near and far.

Egg Quality Extension Programme

The problem of poor egg quality, particularly during the summer months, is a complex one, for it involves the producers, the marketing authority and the retailer. Quality can be affected at any of these points by holding time and temperature. As the initial loss, mainly due to the effect of heat on albumen, is possibly greater at the producer level, efforts were made by means of newspaper articles, radio broadcasts and the *Queensland Agricultural Journal* to stimulate a strong sense of responsibility for maintenance of egg quality amongst producers. A number of farm visits were also made at the request of the Egg Marketing Board to growers whose egg quality is consistently poor.

Measurement of interior quality based on a correlation between egg weight and albumen height was used by officers of the Poultry Section in investigational work

at the Egg Board's grading floor on the accuracy and reliability of the long-established method of grading by candling. It was used also at the Random Sample Test to determine the relative egg quality values of the various breeder entrants. The results of these investigations have shown the very diverse nature of the problem. In relation to the Egg Board investigations, it was revealed that candling is reasonably accurate when the average quality of eggs is high, but errors occur more frequently when the average quality is lower. This was particularly noticeable in the test conducted in January, a month of consistently high temperatures.

Tests were also carried out at Rocklea on the effectiveness of evaporative-type coolers for holding eggs under cool conditions. Neither the charcoal-type cooler nor an electrically operated fan-type cooler forcing air through a water screen was found to be effective during months of high temperature and humidity. Holding temperature was generally 10 deg. F. lower than room temperature, but this was still far above the optimum holding temperature of 58-60 deg. F.

An egg room with refrigeration for cooling and equipment for increasing or lowering humidity will be built at the Poultry Section of the Rocklea Animal Husbandry Research Farm shortly. The Commonwealth Extension Services Grant will provide the necessary funds. This will enable further studies of a more critical nature to be carried out to determine optimum holding temperatures and humidity under coastal conditions.

RESEARCH WORK

Grain and Meat-and-Bone Meal Feeding to Layers

This trial was commenced in January 1960 at the Kairi Regional Experiment Station, and is a repetition of a previous trial at that Station in 1958-59. The reason for repeating the earlier work is the fact that the results obtained then may have been affected by early setbacks in the stock used for the experiment.

Three rations consisting of sorghum and meat-and-bone meal (free choice), maize and meat-and-bone meal (free choice), and an all-mash ration composed of equal parts of sorghum meal and maize meal in addition to meat-and-bone meal are being fed. Results to date tend to show that production on the all-mash ration is superior to either free-choice ration. The food intake per group is similar.

Winter Lighting on the Atherton Tableland

Day-old pullets hatched in June 1959 were forwarded to Kairi Regional Experiment Station, where they were successfully reared. Production commenced in October. Four groups are being subjected to early morning lighting and four groups serving as controls have no additional lighting. A severe outbreak of intestinal coccidiosis occurred in January and was followed by an outbreak of bluecomb. This affected production and caused serious losses. However, progress results show a significant increase in production in the "lit" group. That this would occur was expected, and it is hoped that use can be made of these results to popularise early morning lighting in northern areas.

White French Millet in Chick Rations

White French millet is now used extensively in poultry feeding. As there was little information on its value as a grain in poultry feeding, two experiments were conducted to ascertain the extent to which it could be used. Being a small grain, the opportunity was also taken to see whether the inclusion of it as a whole grain in a chick starter mash would be suitable.

Eight experimental rations were fed in each trial. In the first experiment the calculated gross protein values of the rations were found to vary by 2.5 per cent., but in the second experiment slight alterations to the formulae were made to narrow the range to 0.6 per cent. Table 3 sets out the results obtained in the two trials.

These results would indicate that white French millet is a very suitable grain for inclusion in chick mashes and hence other poultry rations. It appears to be equal in nutritive value to wheat and is just as effective when fed as a whole grain.

Inclusion of Bloodmeal in Poultry Rations

Despite its high protein value, bloodmeal has long been held to be unsuitable for poultry. Earlier work by this Section on the use of bloodmeal as a sole source of protein indicated that poor growth and heavy mortality could follow its use. As a result of requests from the poultry industry through the Poultry Advisory Board, a trial was initiated at Rocklea using levels of 2,5, 5.0, 7.5 and 10.0 per cent. bloodmeal in chick mashes. At the 10 per cent. level, bloodmeal was the sole source of animal protein. All other rations contained various added quantities of meat-and-bone meal to provide equivalent ration protein levels.

The inclusion of up to and including 5 per cent. bloodmeal did not affect weight gains to any extent, there being less than an ounce in weight difference between groups fed this level of bloodmeal and the control without bloodmeal. At the higher levels, weight gains were very significantly lowered. No losses occurred in any of the rations irrespective of bloodmeal content.

A further trial is now in progress using bloodmeal within the range of 1.0 to 5.0 per cent. At five weeks of age, weight gains on all levels are of the same order, the greatest difference being only half-an-ounce per bird between treatments.

Half-sister Breeding Scheme

The half-sister breeding scheme with White Leghorns is now in its third year, and is very similar to the schemes in progress on the majority of co-operating breeding farms. Twelve families are being tested and a marked improvement has been noted in hen-housed production and mortality, thus demonstrating the effectiveness of this method of breeding. Hen-housed production is measured from first egg until May 31 in each year.

Hen-housed production has improved from 43.1 eggs per bird in 1957-58 to 72.82 eggs per bird in 1959-60, and hen-housed mortality has been reduced from 11.8 to 8.61 per cent. A random sample from this group also performed very creditably in the 1958-59 random sample test.

Broiler Breeding Investigations

Selection for fast feathering has been carrieed out on the New Hampshire, Light Sussex and Indian Game breeds at the Rocklea Farm, and dominance for this factor has been established. Breeding stock have been

TABLE 3

WHITE FRENCH MILLET COMPARED WITH WHEATMEAL IN STARTER RATIONS

Ration (grain content only)	Trial 1		Trial 2	
	Av. Weight (grams)	Feed conversion	Av. Weight (grams)	Feed conversion
60% crushed millet	762·3	2·68	886·9	2·81
40% crushed millet + 20% wheatmeal	758·2	2·68	840·4	3·03
20% crushed millet + 40% wheatmeal	815·4	2·68	876·3	2·93
60% wheatmeal	824·4	2·95	806·8	3·10
60% whole millet	752·4	2·65	853·9	2·84
40% whole millet + 20% wheatmeal	823·8	2·69	824·2	2·98
20% whole millet + 40% wheatmeal	778·1	2·76	859·6	3·00
60% wheatmeal	781·1	2·81	851·6	3·15
Means	786·9	2·73	849·8	2·98

further selected on weight and body conformation. Simple crosses between New Hampshires and Light Sussex were made in 1960 and weight gain and feathering are being assessed.

Crosses between White Leghorn males and Indian Game females were made and the progeny are being inbred to see whether a dominant white male can be produced. While the Indian Game is a very heavy bird when mature, it matures more slowly than commercial breeds. The cross between Indian Game and White Leghorn does not make a suitable broiler as regards growth, but it does have good breast conformation.

PULLORUM TESTING AND DISEASE CONTROL

The pullorum testing figures for the year are given in Table 4. The number of hatcheries in which no reactors were detected decreased and the number of reactors increased slightly, but gives no cause for concern. An abnormal flare-up of pullorum disease in one flock accounts for the increased overall percentage, but a wider spread of reactors led to there being fewer "free" flocks.

TABLE 4

PULLORUM TESTING STATISTICS, 1957-58 TO 1959-60

—	1957–58	1958–59	1959–60
Total number of fowls tested	220,300	225,484	258,583
Number tested for registered stock suppliers	215,666	219,920	253,226
Number of registered stock suppliers' flocks tested ..	124	131	118
Number of flocks with no reaction at test	68	78	73
Percentage reaction for State	·07	·13	·16

Registered stock suppliers may now apply for classification of their hatcheries according to their pullorum status. If no reactors are found in the current year's test and none in the previous year, they are classified "pullorum free". "Pullorum clean" status is given to a flock in which there are 0.5 per cent. or fewer reactors. Forty hatcheries have applied for accreditation; of these, 14 have been granted "pullorum free" and 26 "pullorum clean" status.

With the rearing of large numbers of table chickens, diseases such as chronic respiratory disease, fowl pox (in battery brooders), coccodiosis, omphalitis, and the condition of nephritis have become of major importance. Lack of hygiene due to the continuous use of infected equipment serves to perpetuate some of these diseases.

The incidence of mites and lice in flocks has increased due to larger flocks being maintained and less time being available for parasitic control. Roundworm control is now a general practice, but the presence of entero-hepatitis (blackhead) in some farm flocks has emphasised the need for greater attention to caecal worm control.

Outbreaks of stickfast flea occurred in a number of districts, usually in small flocks. One at Zillmere involved a commercial farm, and prompt action was taken to treat all birds and to spray likely breeding areas.

DIVISION OF DAIRYING

The work of the Division was continued in its most important phases of production of milk and cream, processing of dairy products, production recording of dairy cattle and administration of appropriate Acts, including the *Margarine Act of* 1958. Other activities of the Division, in which there is inter-Divisional co-operation, particularly in the field, are in connection with the Commonwealth Dairy Industry Extension Grant and the Dairy Extension Advisory Committees.

DIVERSIFICATION

The trend of recent years for the Queensland dairy industry to move away from its traditional dependence on butter is accelerating, and was more apparent during the year than ever before. Cultured butter, market milk, varieties of cheese other than cheddar, casein and the utilisation of by-products are providing these additional outlets. This will give greater stability to the industry, as its economy will no longer be influenced so strongly by fluctuations of butter prices on export markets.

Twenty-four factories are now equipped for the treatment of two or more products. Several factories initiated programmes for powder production and one for casein manufacture. Roller drying of buttermilk was commenced at Monto Butter Factory during the year, bringing the total number of establishments supplying buttermilk powder to eight. Two associations have purchased the new type plate evaporator, the first to be operated in Australia, to enable an expansion of existing drying operations. Two other plants are proceeding with the installation of equipment to produce spray-dried powders. Small quantities of special fat-fortified milk powder were supplied to the baking industry but the demand was not sufficient to warrant full-scale local manufacture.

Commercial production of unsalted cultured butter for both the local trade and trial export shipments was continued in three plants during the year. Comments on export consignments to the United Kingdom indicated that this product was suitable and compared favourably with the Danish butters. Its favourable reception indicates that sales can be expected to increase.

Steady interest has been maintained in the production of non-cheddar type cheese of both semi-hard and soft condition. Two varieties, Gouda and Edam, are being produced in addition to a small amount of spiced varieties of cheddar cheese. Following the return of the Division's cheese technologist from an overseas study tour, it is anticipated that several new varieties will be introduced in the near future. Since many Australians are only just beginning to realise the attractiveness of a variety of cheeses, there is room for expansion in this branch of the industry.

Considerable headway was made with the production of pre-packed rindless cheese, the sale of which increased on the local market. The pioneering work in Australia on this type of cheese was done in Queensland. Suitable factory premises and equipment and correct techniques in manufacture and packaging are essentials for this trade. Eleven cheese factories in the State have installed equipment for this form of packaging. As part of a controlled export programme under the supervision of the Australian Dairy Produce Board, four Queensland cheese factories were licensed to export rindless cheese, following recommendations by Departmental officers. Grading results on approximately 50,000 lb. of such cheese exported to the United Kingdom were satisfactory.

QUALITY

Queensland is the only country with warm climatic conditions which exports dairy produce to the United Kingdom market. While the top quality butter and cheese, although proportionately lower in quantity, compares favourably with the produce of any major dairying country, there is room for an appreciable uplift

DEVELOPING BUTTERFAT SPREADS

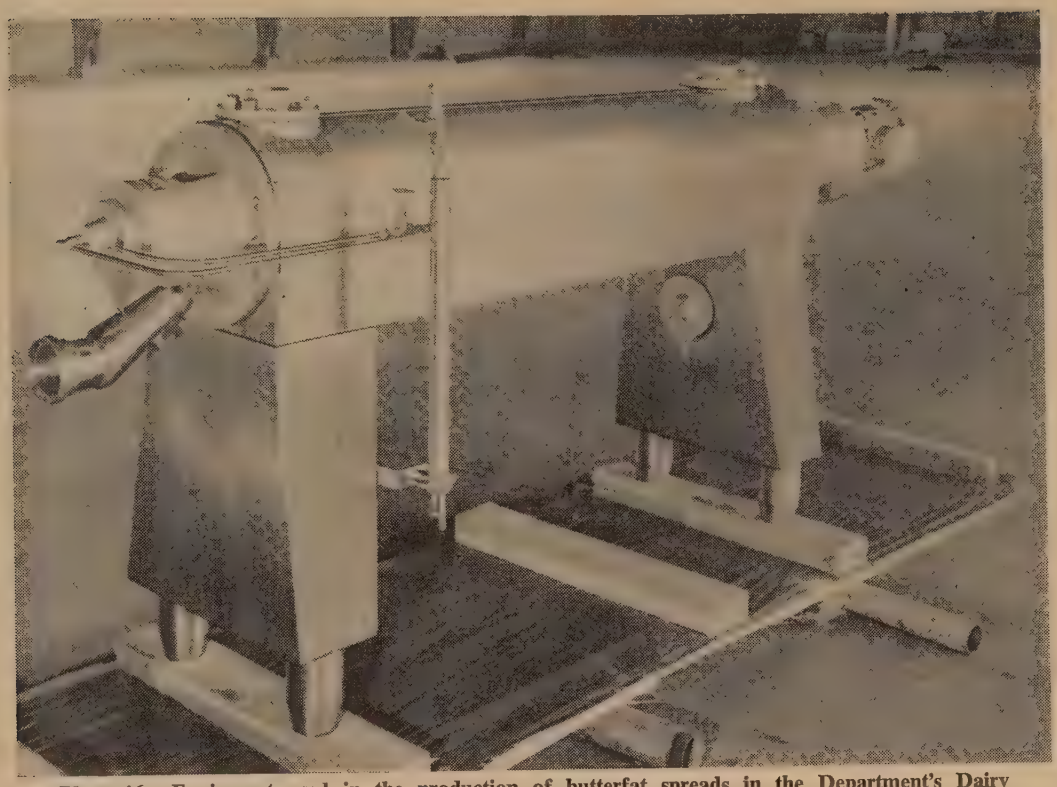


Plate 46.—Equipment used in the production of butterfat spreads in the Department's Dairy Research Laboratory.

Plate 47.—Butterfat spreads used as cake fillings, toppings and frostings.

DAIRY FACTORY FACILITIES

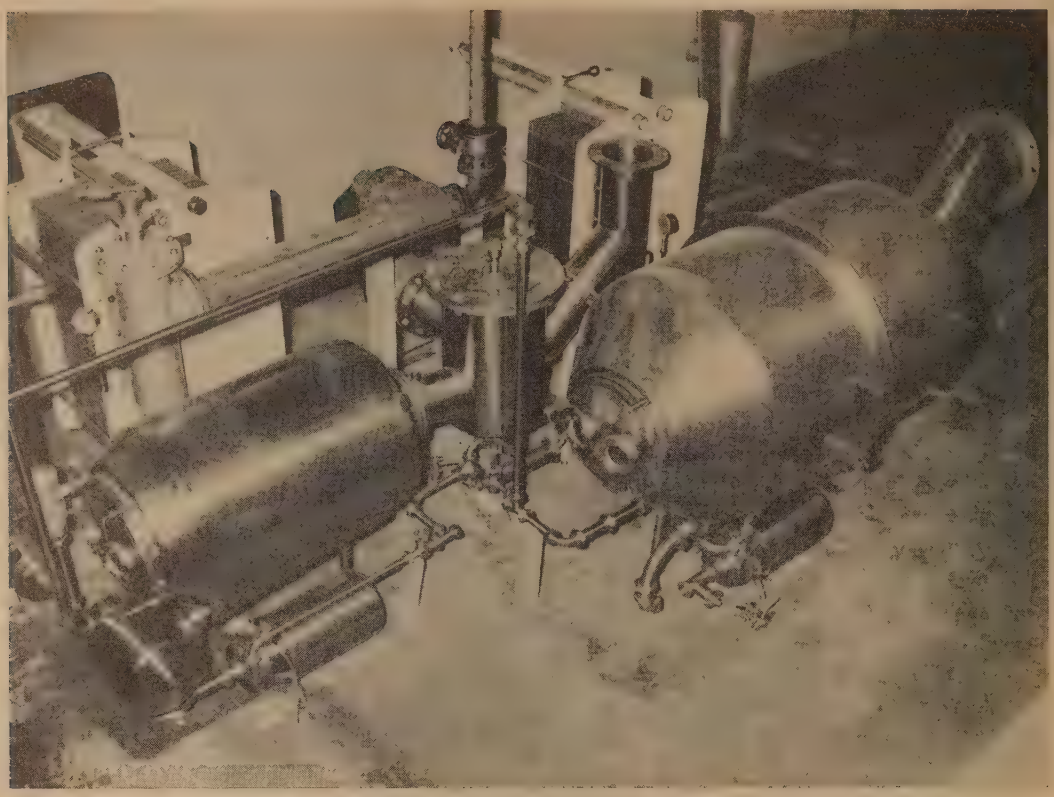


Plate 48.—The first of its kind in Australia, a double-effect plate evaporator installed in a Queensland factory for the concentration of milk.

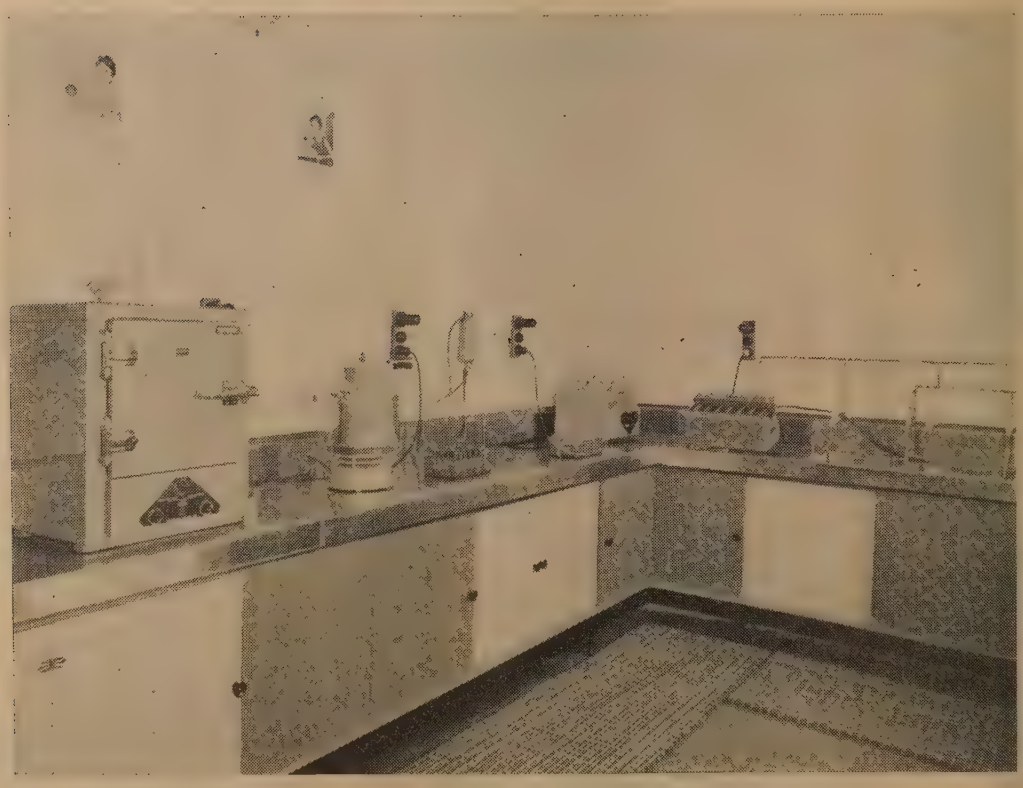


Plate 49.—Portion of a new factory laboratory for testing milk for thermoduric (heat-resisting) bacteria.

in the general overall quality. It is pleasing to record that for this year butter quality showed some improvement, and cheese quality was maintained at the satisfactory level of recent years.

Departmental and factory laboratory quality control services have helped raise the chemical and bacteriological quality of dairy produce. Over 50,000 samples of milk, butter, cheese and other dairy products were submitted to almost 100,000 tests.

Four more laboratories were established by co-operative dairy associations for the purpose of regularly testing supplies received and to aid in raising quality of produce. Sixteen such control laboratories have been, or are being, established. The staff has been trained in the Departmental laboratories to ensure uniform control. The acceptance of responsibility by the industry for its own laboratory quality control services augurs well for the future. The establishment of laboratories and the training of technologists must play an increasingly important part in raising the technical efficiency of production and processing of dairy products.

The bacterial counts of butter were lower than in any other year since the inception of the butter quality improvement service in 1940. Laboratory tests on over 30,000 samples revealed that the composition and processing of Queensland butters are generally efficiently controlled, and it is clear that the quality of the farm cream supplies is the major limiting factor to further butter quality improvement.

The general adoption of filtration for the removal of extraneous matter from cream was evident during the year. It resulted from a requirement of the Commonwealth Export Regulations that this practice is now a prerequisite to registration of a factory. In most factories filtration is carried out through nylon material. The need for this technique during manufacture highlights the importance of farm control measures during production.

The quality of cheese continues to be encouraging, a total of 82.8 per cent. being graded choice and first quality. In order to ensure that only cheese of satisfactory quality was supplied to the local market, some associations commenced a voluntary system of grading supplies prior to sale.

A significant achievement in the control of milk quality was the initiation of the bacteriological examination of milk by two cheese factories which also supply market milk to Brisbane. These factories possess their own laboratories and equipment for carrying out thermoduric tests of milk. Three other cheese factories are planning to do likewise.

Divisional officers are effectively playing their part by research, advisory services and demonstrations in helping to solve the problems in connection with milk and cream quality and processing techniques, but their solution will depend on an even closer partnership between all directly connected with the industry and Departmental officers in the more rapid transference of existing knowledge into daily practices on farms and in factories.

MODERNISATION OF FACTORIES AND EQUIPMENT

The modernisation of factory premises and equipment continued and an estimated total expenditure of £250,000 was incurred by Associations in this respect. At present some 27 stainless steel churn barrels are in operation throughout the State and it is anticipated that this trend will continue. Coupled with an increasing awareness by managements of modern sanitation procedures and intensified factory advisory visits by senior field officers, the installation of stainless steel equipment resulted in a distinct reduction of the bacterial counts of butter.

Initial steps were taken to introduce fibreboard butter boxes. These will be approximately 1s. 6d. cheaper in Brisbane than the present composite (fibreboard and wood) box and would mean an overall saving in Queensland of up to £150,000 annually.

Considerable renovation of cheese factory buildings and installation of equipment was undertaken. Amounts of £36,807 for renovating, and £64,641 for buildings and equipment were expended by Associations. Kraft's Quinalow and Kenilworth factories were remodelled for increased output, and expansion of the Woodford factory was commenced. A commendable feature of the renovations is the endeavour to protect the product from contamination. Two Associations improved the manufacturing sections with suitable screening devices to control the incidence of flies.

Milk factories continued to make progress in the provision of modern milk receival and treatment equipment. Expenditure in this respect was approximately £130,000, which is slightly less than in the previous year.

MILKING TECHNIQUE

Good milking shed practices are not only effective in protecting the quality of the milk and cream, but in attaining the maximum yield. Following New Zealand research which has shown that they enable about 20 per cent. more milk to be let down by the cow—surely a worthwhile objective which only costs a systematic adherence to proven hygienic and milking procedures in the dairy shed routine—investigations were commenced with a view to their applicability to Queensland conditions. Equipment devised by a Divisional officer is expected to contribute substantially to the research work.

RESEARCH

A notable feature of the research work was the availability for the first time of financial support from industry funds. This was made possible by the inauguration of a research and promotion scheme by the Australian Dairy Produce Board, under which it will in future contribute financially to research activities being carried out in already established research institutes. Some problems are facing these institutes in recruiting trained staff for the expanded investigational programme, but fortunately this Division has the nucleus of a well-trained research team. An appreciable proportion of the funds for the Queensland programme in the first year was required for the purchase of scientific equipment. Already the financial provision has enabled some projects to be pushed forward more rapidly.

A method for the removal of weed taint from butter-oil has been evolved. This offers promise of providing a ready market for the product, much of which has been difficult to dispose of in the past due to weed taint. A type of cultured butter has been produced. The results of these researches have already been translated into commercial practice. Good progress has been made in experimental aspects of other projects, although commercial trials cannot be finalised until certain equipment is received. These projects relate to butter spreads, the alleviation of weed taint in milk and cream, the development of certain varieties of cheese and storage defects of cheese.

In the past, research has been hampered by an acute shortage of accommodation and lack of facilities for pilot plant trials. Plans are being prepared for a dairy research laboratory and pilot plant embodying laboratories and pilot plant facilities for the manufacture and storage of a variety of dairy products. These new laboratories will greatly facilitate the research work of the Division.

Laboratory control services are complementary to research and extension activities in all aspects of the Divisional programmes. A reference to the report of the Research Branch will clearly show the extent to which they are being applied to quality improvement on farms and in factories, achieving economy and efficiency in processing, and the development of new products.

OTHER ACTIVITIES

Projects connected with the Commonwealth Dairy Industry Extension Grant and the Dairy Extension Advisory Committees have considerably increased the

volume of extension work performed by Divisional officers. Collaboration between Departmental officers and industry organisations in improved extension methods is not only helping to hasten the more widespread adoption of recommended farming practices, but inspiring confidence between the farming community and the field officers.

There is increasing evidence of the influence which herd recording, properly applied, can be in raising the productive level of dairy herds. While membership of group herd recording was somewhat lower, herds recorded under the Pure Bred Herd Production Recording Scheme reached record numbers. A perusal of the details in the report of the Field Services Branch will provide information which should be of interest to all engaged in the dairying industry.

STAFF

The staff position was slightly improved during the year, mainly due to the recruitment of junior personnel, but there is still difficulty in recruiting graduates. The appointment of a Senior Chemist in the Dairy Research Branch was the only change in more senior staff positions.

FIELD SERVICES BRANCH

The principal function of the Field Services Branch is to improve the quality of dairy products, and to assist in their efficient and economical production. The Branch provides an advisory service to more than 17,000 dairy farmers throughout the State and also to the managers and staffs of 80 butter, cheese and pasteurised milk factories. It also operates two main types of herd production recording schemes, one for the recording of pure-bred dairy cattle and the other for grade dairy cattle. Associated with herd recording, surveys are made of various aspects of dairy farming practices.

EXTENSION WORK

The staff of 66 officers is composed almost entirely of personnel who have attended Departmental schools in extension methods. The value obtained from such training is becoming more evident each year as officers gain confidence and ability in addressing groups of farmers, become proficient in the preparation of articles, radio talks and news items, and gain skill in the use of the camera and film projector and the organising of field events.

The training of officers at Extension Schools commenced six years ago and at that time approximately 23,000 farm visits were made annually. This was then the main method of extension. Since then it has become possible by the use of additional methods to more than double this number of farmer contacts. In the past year 25,230 farm visits were made, while attendances at field days, tours, method demonstrations, &c., were 30,739, giving a total of 55,969. Last year the total was 48,557. In addition, more than 11,000 calls were made by farmers to the offices of country staff for information and advice and large numbers obtained information from officers at the numerous dairy exhibits staged at country shows.

The task of keeping farmers and factory managers informed concerning better methods of production and manufacture is a very responsible one. Field work has to be planned to ensure general compliance with the Dairy Produce Acts, both on the farm and in the factory, and efficient use of time available for mass media education. In this respect officers are receiving increasing collaboration from farmers and factory managers.

The second Farmers' Festival was successfully staged at Biddeston, near Toowoomba. This was organised by the Eastern Downs Dairy Extension Advisory Committee, a body representative of the Eastern Downs Council of the Queensland Dairymen's Organisation and the Department of Agriculture and Stock. The Festival gives the opportunity to make contact with technical specialists and to discuss modern trends over a broad field of rural technology.

Queensland dairymen have expressed a preference for films depicting Australian conditions. In previous years films from other countries predominated but fortunately a greater proportion of the films available is now Australian. An additional film projector was obtained this year and the Division now has four, which are strategically placed throughout the dairying districts.

Farm walks are arranged to show groups of farmers improved pastures, modern dairy premises, fodder conservation, and so on. Officers are encouraged to arrange these events and it is evident that they are becoming popular, as attendances were approximately twice as great as in the previous year.

Substantial encouragement was again given to the Junior Farmers' Organisation and 88 meetings were attended and several talks given.

Fifteen articles were published in the *Queensland Agricultural Journal*, three technical articles were released in other publications, 23 News Bulletin items were prepared and four A.B.C. "Country Hour" broadcasts were delivered.

Due to the need for quality improvement and more economical production of dairy produce, extension work during the year was mainly concentrated on matters affecting hygiene in the dairy, herd recording and the adoption of recommended practices in factories. Some encouraging results were obtained as a result of this work.

During the year a special technical training school for senior butter factory operatives was conducted at the Queensland Agricultural High School and College in association with the Australian Society of Dairy Technology, the Australian Dairy Factory Managers and Secretaries Institute and the College authorities. A total of 15 students attended for a week's instruction and the programme was planned to provide a combination of theoretical and practical instruction. Industry response to this course was most heartening and the number of applicants exceeded the number of vacancies available.

As portion of the Branch's advisory programme a short two-day course for cheese factory operatives was held in Toowoomba. Lectures and demonstrations embraced testing, grading and manufacturing operations. The course was arranged to assist operatives to qualify for the Departmental Cheesemakers' Certificate.

QUALITY OF DAIRY PRODUCE

Encouraged by a decision reached at a conference of dairy industry organisations last year to attempt to improve the quality of Queensland dairy produce, a comprehensive Branch programme was prepared and implemented. Officers sought the co-operation of farmers in a drive to increase production and to raise the standard of quality so that local sales might be increased and new markets more easily obtained. They were advised that the long-range benefit of increased sales on the most profitable markets would ultimately be well worth the effort.

Officers concentrated their work on seven main essentials in endeavouring to achieve the desired objective. These were (1) hygiene, (2) adequate water supplies for dairy premises and stock, (3) cooling, (4) provision of adequate dairy premises and equipment, (5) herd recording, (6) milking machine efficiency, and (7) the adoption of recommended practices in factories. While some farmers remain apathetic towards quality improvement, it is obvious that a growing number has come

to realise that quality is paramount in this competitive world. The result of the drive was encouraging, the percentage of choice quality butter being raised from 33.81 per cent. last year to 40.63 per cent. this year.

During the 12 months a worthwhile example was set by the Esk Co-operative Dairy Association. The objective of the Association was to uplift borderline cream supplied by farmers. It first put its own house in order by ensuring that the factory plant was adequate for the best results. All suppliers were then informed by letter of the plan for the quality improvement drive. Letters were sent by the Dairy Officer to every supplier of borderline choice cream, asking him to carefully examine the methods in his dairy and offering to visit the farm to assist, if necessary. The Association adopted the practice of sending an advice card coloured blue to each supplier who sent in at least 75 per cent. of choice grade cream during the month, a red card to a supplier with 50-75 per cent. choice, and a yellow card to a supplier with less than 50 per cent. choice grade. As a result of the keenness and co-operation of the farmers, Esk butter has since shown an appreciable improvement in quality.

During the period under review field officers of the Branch co-operated closely with the managements of 11 butter factories which had had a high percentage of butter degraded in the previous two years. This programme was initiated following the 1957-58 season, when only 45.6 per cent. of choice butter submitted by these factories was scored true-to-grade. A concerted effort by officers effected an improvement in the 1958-59 season, which, incidentally, was characterised by severe weed taints, when the percentage was raised to 59.7. Consistent attention to these factories saw a further improvement this year, when 71.7 per cent. was packed according to grade. As a result of dry conditions during April, May and June this year butter degradings due to weed taints were not as severe as in previous years.

The chemical quality of market milk was satisfactorily maintained, whilst the bacteriological quality generally showed a substantial improvement. The latter was due mainly to the introduction of a programme of thermoduric testing of milk supplies by a number of milk factories.

The follow-up work by Dairy Officers to those farms supplying unsatisfactory milk, and the application of penalties by factories to farmers consistently supplying such milk, proved very effective.

Concerted action is being taken by Branch field officers in collaboration with the Brisbane Milk Board to ensure that the premises, equipment and hygiene of milk producers supplying direct to Brisbane are satisfactory prior to registration or renewal of registration with the Board. Good progress has been made in this work.

With the extension of electrification in country areas the number of milk suppliers installing farm refrigerators is increasing. The provision of refrigeration enables the farmer to supply his total farm milk production all the year round. Hitherto, without a refrigerator or a twice-a-day milk pick-up, the supplier was obliged to separate his evening's milk.

An analysis of temperature variations of milk during transport to Brisbane factories in vehicles of differing construction indicated that protection from air movement around can surfaces in vehicles with closed superstructure resulted in a significantly lower temperature than in milk conveyed in the conventional slatted-side vehicle. This was particularly evident with refrigerated milks, where average milk temperature increased from 46.2 to 58.8 deg. F. in fully enclosed vehicles, in contrast with an increase from 46.9 to 63.8 deg. in the conventional slat-type construction.

Preliminary investigations into the practicability of bulk collection of farm milk were initiated in three milk-producing districts.

A special investigation into farm control measures to alleviate the incidence of weed taints in dairy produce was commenced during the 1959 weed season. It was possible to demonstrate means of elimination, in a crop of oats, of milk-tainting weeds. This was achieved through the application of MCPA. A second trial to examine the practicability of controlled grazing of weed-infested pastures was inconclusive, due to the late establishment of the experimental pasture area. Investigations into the latter technique are being continued.

DAIRY FARM FACILITIES

While a high standard of hygiene is the most important factor in the production of good quality milk and cream, its employment is facilitated if good premises and equipment are provided. Steady improvement has been made in the provision of satisfactory premises, 83 per cent. now being satisfactory. But for the present high cost of materials and equipment on the one hand and somewhat low returns on the other, greater progress would be made. The herringbone type of shed is being accepted very slowly, but farmers who have built this type claim a considerable saving of time and labour.

The extension of rural electrification has meant a further increase in the installation of electric hot water systems, there being 30 per cent. more than last year. There are 87 per cent. of dairy premises equipped with satisfactory hot water facilities.

Market milk supply farms are, generally, suitably equipped with cooling facilities, and several officers report that all market milk suppliers in their districts possess adequate milk coolers. Most suppliers of milk to cheese factories cool their milk, many using the tower system with good results. The cooling of cream is making slower progress, as the price differential between choice and lower grades of cream is so narrow that the installation of a refrigerator is considered by many to be uneconomical.

Price inducement plays the most important part in the adoption of a high standard of cleanliness on the farm. Thus the standard observed on market milk supply farms is generally good. However, officers participating in the Branch's quality improvement drive have encouraged cream suppliers to improve their methods, the result being an improvement in the quality of choice grade butter being manufactured. The introduction of improved detergents and chemical sterilants is assisting farmers in the more effective cleansing and sterilizing of dairy equipment.

DAIRY FARM MACHINERY

Milking Machines.—The proper cleaning, care and adjustment of the milking machine is one of the most important aspects on Queensland farms, where most herds are now machine-milked. During the year almost all phases of work connected with dairy machinery were covered, the most important being that of the milking machine testing service. Field officers possess air flow meters and vacuum recorders with which to check the mechanical efficiency of milking machines. They are competent in their use and are able to make adjustments if the tests reveal the necessity for them.

Since the inception of this free service three years ago 2,549 milking machines have been examined. During this period 32 testing outfits were available for the work and 13 additional sets were purchased at the end of the year. This valuable service will thus now be appreciably expanded. In many cases farmers were somewhat reticent in taking advantage of the service but those who accepted it regard it highly. A growing number of dairy farmers are making a practice of seeking the services of officers in an annual check of their milking machines.

Of the 905 machines examined during the year, only 6 per cent. were found to be without any faults. The necessity for more work in this field is thus clearly indicated.

A recording instrument, to be used in determining the influence of factors affecting the physiological let-down of milk and the efficiency of machine milking of cows, has been designed and constructed by a Senior Dairy Adviser. Some preliminary work was carried out with this equipment in North Queensland last year when a study was made of the rate of milking of dairy cows. Additional investigations, however, are necessary into milking machine efficiency. These include the effect on milking speeds of different pulsation ratios and rates, udder stimulation and the effect of stripping at different flow rates on milking time and milk yield. To this end a farm in the Ipswich district has been

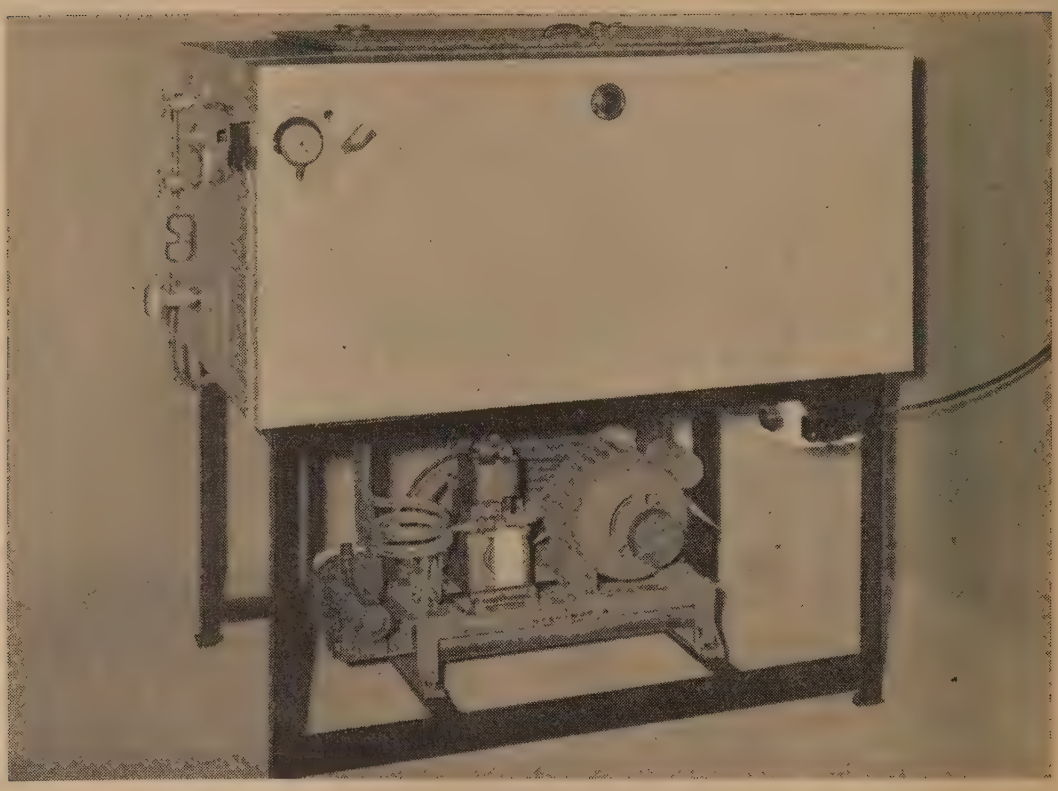


Plate 50.—A type of farm bulk milk refrigerator under trial in Queensland.

Plate 51.—Interior of a modern milk room on a Queensland dairy farm.

selected for further trials. An experimental plan has been prepared in consultation with the Biometrician, and the Dairy Research Branch will collaborate in the investigations.

Milking machine efficiency and milking methods are subjects which require further research if maximum production is to be obtained. Probably the dairyman's biggest problem today is how to reduce the cost of production. Greater efficiency in the milking shed will assist him in this respect. Results of the preliminary trials suggest that useful data and information which could throw a new light on milking machine practices may be obtained and as it will be done under Queensland conditions it will have more impact than results taken from studies in other countries.

Effect of Metals on Dairy Produce.—The presence in dairy produce of copper and iron, derived from the material used in the construction of milking machines, separators, milk vats, &c., has caused some concern. Dairy machinery firms are therefore endeavouring to provide equipment which does not contain these metals, and without unduly increasing costs. Materials made of stainless steel and glass are now being freely used and a milking machine constructed entirely of these two materials is now available. Milk vats with stainless steel bottoms and aluminium milk and cream cans can now be obtained. It is now possible to transport dairy produce from the cow to the factory without the danger of contamination from copper or iron. Stainless steel and glass equipment is initially more expensive but its longer life offsets the capital cost. Separators constructed of bronze and tinned steel have practically disappeared, having been replaced by separators made wholly or partly of stainless steel. The longer life of the latter reduces replacement costs and thus assists in lowering the cost of production.

Surveys and Investigations.—A survey was conducted during the year to ascertain the life of the layer of tin inside a milking machine milk-pipe. From a visual examination of 58 machines, it was found that the tin was partially stripped from four of them after only two years of operation, while the majority retained the tin for over six years. Officers are now endeavouring to find reasons for the early loss of tin on some machines and for the long life of the tin in others. They are visiting the farms to ascertain cleaning and handling methods. It is hoped that this survey may make it possible to offer advice for prolonging the life of the tinned surfaces.

An attempt was made to ascertain if modern detergents and wetting agents are harmful to vacuum pumps. Farmers supplied conflicting information and in many cases the history of the equipment could not be traced. Some vacuum pumps failed after a short period when wetting agents were used, while others were not adversely affected.

Enquiries were made into the early rusting of new cans, particularly milk cans. Complaints had been received concerning deterioration of the metal surfaces soon after purchase. Numerous faulty cans were inspected and the Dairy Research Branch is conducting tests on samples of tinned steel.

COMMONWEALTH DAIRY INDUSTRY EXTENSION GRANT

The season was only fair for pasture demonstrations. Dryland pastures grew prolifically in the spring but deteriorated quickly in late summer. Irrigated pastures had to be watered in February and March due to lack of normal rains. The heavy spring rains were favourable for water runoff. Dams on two water-harvesting demonstrations which had remained empty for two years were filled to overflowing. The dry autumn reduced fodder crop yields on several silage-making projects. Greatest interest was shown in easier ways of feeding silage. Of 21 silage-making demonstrations, seven were of the self-feeding bunker (or clamp) type.

Silage-making demonstrations have had a big influence in changing the feeding pattern of dairy cows on many farms. Prior to the disastrous 1951 drought about 10,000 tons of silage were made annually in the five main dairying districts of the State. Between the 1951 and 1957 droughts the amount increased to 15,000 tons annually. In 1958 about 25,000 tons of silage were made, while in the past year the figure rose to 60,000 tons.

Some interesting information on costs and returns was obtained on the first year's operations on one water-harvesting demonstration. The results indicate the economic soundness of this project.

There were 114 farm demonstrations at the beginning of the year; 28 projects were terminated; and 25 new demonstrations were approved during the year.

Other demonstration projects include the farm cooling of milk and cream, the more effective cleaning of milking machines and dairy utensils, and the value of supplementary feeding of improved pastures for improvement of the composition and yield of milk. New and cheaper types of farm refrigerators have proved most helpful for the improvement in quality of milk and cream under our warm climatic conditions.

Farm demonstrations were the focal point for many extension gatherings. During the year 19 field days were conducted on co-operating farms. Attendances averaged 40 persons. This is evidence that interest in demonstrations is not waning to any extent, and that there is a general desire for knowledge by many farmers.

Grant funds were used to prepare an exhibit for the 1959 Royal National Exhibition. The theme of the exhibit was "Increased Production through Herd Recording." As in past years the exhibit was later displayed at the main country shows.

The normal extension programme of the Branch was assisted by the use of projectors, cameras, coloured slides and black and white photographs, financed through the Grant. Farm demonstrations were publicised in the press and the *Queensland Agricultural Journal.*

DAIRY EXTENSION ADVISORY COMMITTEES

Dairy Extension Advisory Committees, which operate in the nine major dairying districts, are helping to bridge the gap between agricultural knowledge and its practice on the farm. These committees are associated with most dairy extension functions. The outstanding achievement of these committees is the conducting of the Farmers' Festival at Toowoomba, which was attended by some 15,500 people. By giving the dairymen a stake in planning extension activities, greater farmer-Departmental goodwill was established.

HERD PRODUCTION RECORDING

Herd recording provides information which allows the owner to compare the production of cows within his own herd and to assess the value of his farm and herd management. It provides factual information on which to base culling programmes to indicate the higher yielding cow families from which to breed herd replacements. It also indicates if the herd sire is improving or lowering production.

Owing to the differences in management and environment, herd recording does not give a true comparison of the productive ability between cows in different herds. In the past, farmers tended to make such comparisons and to attribute the effects of good management to the superior genetical characteristics of the cows. This unfortunate tendency to compare production records of cows in other herds instead of within their own herd appears to be one of the reasons why more farmers do not record their herds for production. Many wish to record only during good seasons so that they may claim that their cows have high production records. Unfortunately, the relationship of herd recording to farm development programmes is not fully appreciated. While the rate of capital improvement on the majority of dairying properties in Queensland is somewhat protracted, herd recording data provide information for herd and farm improvement which can be effected immediately. In the meantime, farmers can improve their herds by selection of the progeny of animals which yield best under the existing conditions. Such selection should be made on production records. Research is being conducted into the importance of cow families in herd production.

It is disappointing that the number of farmers recording their herds remains stationary at about 7 per cent. It is hoped, however, that extension work will result in a much greater demand in the future for this valuable service.

Pure Bred Production Recording

The compulsory recording of the whole herd under the official Pure Bred Production Recording Scheme was obligatory from July 1, 1958. The year under review is the first in which the full effect of this action has been felt.

A meeting of representatives of the various breed societies, dairying organisations and the Department was held in June 1959 to discuss the rules governing the recording of purebred dairy cattle and further discussions took place during the year. As a result, the length of lactation for official statistical purposes will be reduced from 300 to 270 days. It was decided that the recording of the whole of the herd would be reconsidered in 1961. The views of the Stock Breeders' Association on the deletion or revision of age production standards for entry into the Advanced Register of the Various herd books were sought, but finality has not yet been reached.

During the year cows from 153 herds were submitted for recording, compared with 120 herds in the previous year.

Completed lactations of 300 days or less were made by 2,791 cows for an average production of 6,459 lb. milk and 282 lb. butterfat. Of these animals 989 yielded the required age production standard for entry into the advanced registers of the respective herd books.

The average production for cows of the various breeds is shown in Table 1.

TABLE 1

AVERAGE PRODUCTION OF PUREBRED COWS, ACCORDING TO BREED

Breed	No. of Cows	Average Production		
		Milk	Test	Butterfat
		Lb.	%	Lb.
A.I.S.	1,119	7,324	4.0	290
Ayrshire	63	7,569	4.2	315
Friesian	151	7,796	3.4	266
Guernsey	256	6,527	4.5	294
Jersey	1,202	5,455	5.0	273
Total	2,791	6,459	4.4	282

Sire Surveying.—A brochure was issued showing the results of surveys conducted on bulls used in herds recorded under the Pure Bred Production Recording Scheme. The method used for the surveys was based on the technique used successfully in New Zealand but modified to suit Queensland conditions. The bulls were given a rating showing the degree to which they were raising or lowering production.

Commercial dairymen have expressed their appreciation of the information contained in the brochure and are using it to select future herd sires.

Table 2 shows the numbers of bulls of each breed which were surveyed and the number with plus and minus ratings.

TABLE 2

SIRES SURVEYED ACCORDING TO BREED AND THEIR PERFORMANCES

Breed	No. of Bulls	Number of Bulls	
		Plus Rating	Minus Rating
A.I.S.	41	22	19
Ayrshire	2	1	1
Friesian	3	2	1
Guernsey	7	5	2
Jersey	44	28	16
Total	97	58	39
Percentage	..	60	40

Register of Merit.—The Register of Merit for dairy cows places on record cows which calve regularly and give consistently high yields. In order to ensure that there is sound productive ability on the female side, many commercial dairymen are now seeking bulls whose female ancestors have qualified for entry into the Register of Merit. Previously it was their practice to select bulls on the results of one lactation record of the dam.

During the year four cows qualified for entry into the Elite Section of the Register. In order to qualify, a cow must produce 3,600 lb. of fat in not more than 10 recorded lactations. Entry into this section is rare and the recent admissions bring the total number of Elite Merit Register cows to 11. Cows entering the Lifetime Section (2,240 lb. fat in not more than eight lactations) numbered 46, compared with 32 last year. The number entering the Intermediate Section (1,100 lb. fat in three successive lactations) dropped from 90 last year to 66 this year.

The number of cows of each breed admitted to the various sections of the Merit Register during 1959-60 is shown in Table 3.

TABLE 3

NUMBER OF COWS ADMITTED TO THE MERIT REGISTER IN 1959–60

Breed	Section of Register		
	Elite	Lifetime	Intermediate
A.I.S.	4	23	21
Ayrshire	—	4	3
Friesian	—	1	3
Guernsey	—	3	10
Jersey	—	15	29
Total	4	46	66

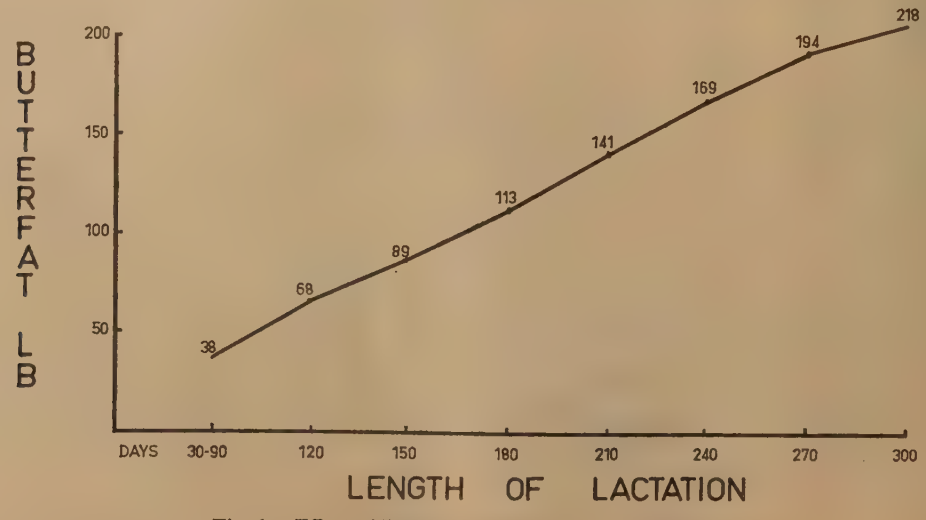


Fig. 1.—Effect of Length of Lactation on Production.

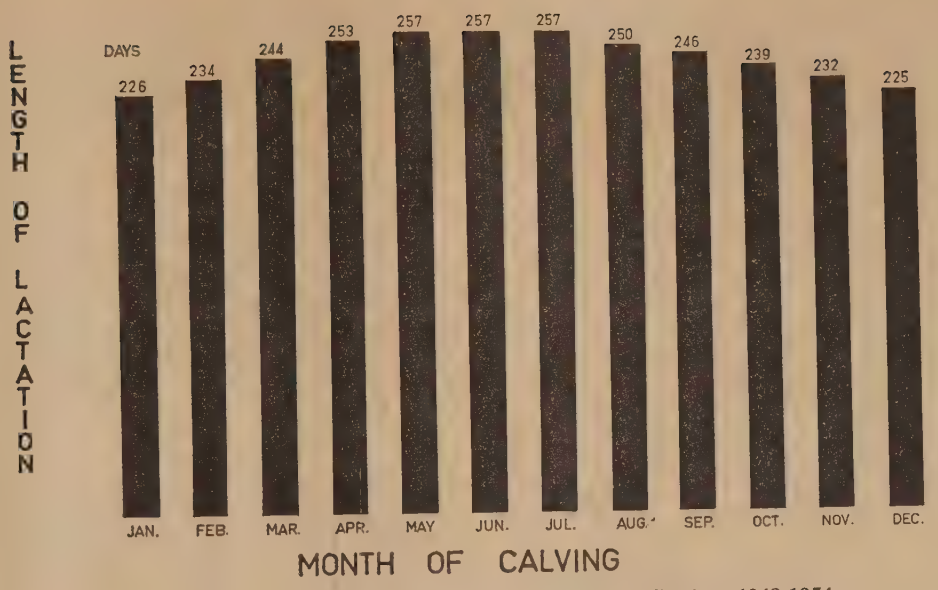


Fig. 2.—Relation of Length of Lactation to Month of Calving, 1948-1954.

The existing standards for admission to the Intermediate section of the Register have been modified to suit Queensland conditions. The period between consecutive calvings has been reduced from 18 to 15 months. The production of fat for three successive lactations has been reduced in respect of cows commencing their first lactation under the age of 2½ years from 1,050 to 950 lb., and in the case of cows over 3½ years from 1,100 to 1,050 lb. butterfat. Cows commencing their first recorded lactation between the ages of 2½ and 3½ years are required to yield at least 1,000 lb. fat instead of 1,100 lb. The amended rules become effective from July 1, 1960.

Merit Stud Register.—As an encouragement to breeders and as a guide to selection for commercial dairymen, a Merit Stud Register has been instituted. The Register lists those herds which contain a good proportion of cows which have entered the Register of Merit. The Merit Stud Register was instituted after discussion with representatives of the dairy cattle breed societies. At least 40 per cent. of cows over four years of age must be entered in the Register of Merit for dairy cows for a herd to qualify as a Merit Stud herd.

Group Herd Recording

During the year some groups with low memberships were amalgamated. In this way the overall number of herd recorders required was reduced by one. After redistribution of herds the membership of groups was well maintained. This is important, as full group membership cushions the effects of increased wages and rising cost of equipment.

In the 1958-59 herd recording year ended on September 30, 1959, 43,412 cows from 1,259 herds completed record lactations. The average production of recorded cows was 402 gal. milk and 170 lb. fat. The average fat content was 4.2 per cent., this being the highest ever recorded. The previous highest fat was 155 lb. in 1956, while in 1958 it was 143 lb. Although some of the increase in production was due to the favourable seasonal conditions, portion of it must be attributed to improved farm and herd management adopted by recording farmers.

The average length of lactation was 243 days, which compares favourably with 247 days in 1958, the highest figure yet reached. The change in the length of lactation is one of the noticeable features of herd recording. It has increased by approximately one month since the inception of recording in 1948. In order to impress on farmers the necessity for a longer lactation period a further survey was carried out to show the production obtained by lactations of varying lengths. This is depicted in Figure 1.

Sire Surveying.—Interest in sire surveying is increasing each year, and the service now forms a most important part of herd recording. Farmers not only ask for a survey of their herd sires but they seek new herd bulls

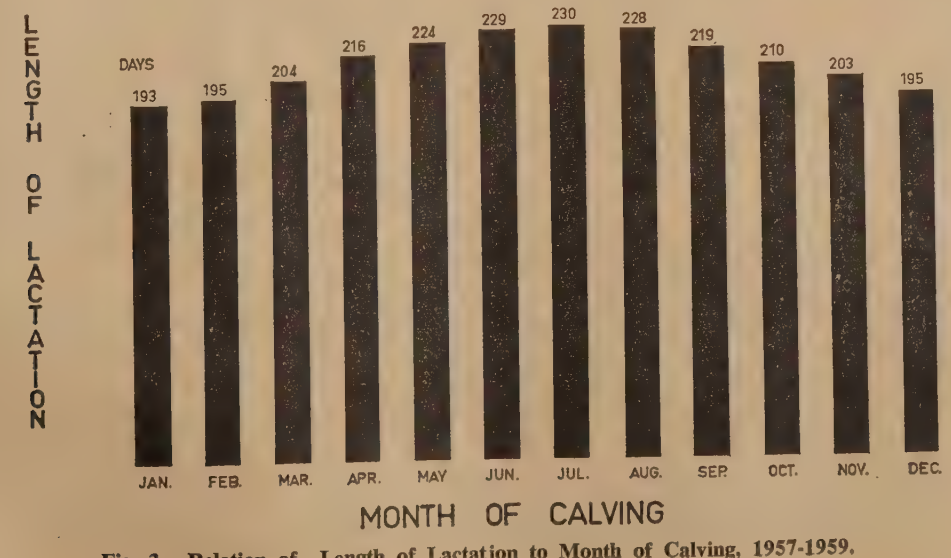


Fig. 3.—Relation of Length of Lactation to Month of Calving, 1957-1959.

on the results of previous sire surveys and production records of cows. Many dairymen now seek the advice of the Herd Recording Section before purchasing a new bull.

Surveys were made of 350 bulls compared with 248 last year and 139 in 1958. Of the bulls surveyed, 28 per cent. were raising production, 53 per cent. maintaining it and 19 per cent. lowering it.

Latest developments in sire surveying overseas are being studied carefully with a view to adapting them to Queensland conditions.

Calf Identification.—During the year 9,611 heifer calves from 705 herds were ear-tattooed by herd recorders to provide a permanent identification for the owner, compared with 7,457 calves from 650 herds in the previous year.

Month of Calving and Lactation Length.—A survey of production records for 1957 to 1959 shows a trend away from the results of previous surveys. This change is depicted in Figures 2 and 3. It appears to be due to the adoption of better farming methods, including improvement of pastures, both dryland and irrigated.

Analysis of Herd Records.—For the first time, herd records of members who have recorded for two years or more were analysed. In this way production records of individual cows were examined carefully for more than one lactation. This detailed study of records assists members in drawing up programmes for breeding better replacement stock and culling the poorest producers.

Extension.—By means of annual meetings, conducted tours, field days, farm visits, radio talks, press articles and a monthly publication termed "Herd Recording Notes," extension work on herd recording is actively pursued. The analysing of herd records in detail provided material for use by extension officers. The results of surveys were made available through the above media and extension officers used them during farm visits.

General.—During the year an additional tabulator was added to the machines installed at the Government Statistician's Office. The machines are now used extensively in the preparation of monthly and yearly data sent to all farmers whose herds are production recorded.

DAIRY RESEARCH BRANCH

Queensland has the most highly developed dairying industry of any country with a tropical and subtropical environment. The problems under these conditions are most difficult and diverse and it has been possible to produce dairy products comparable in quality with those of other countries only by effective research and its application. This work must be continued and expanded to assist in the solution of problems of production and manufacture. The research programmes and laboratory quality control services have therefore been planned accordingly.

The economic stability of the dairying industry in Queensland has been based mainly on a butter economy. With a somewhat uncertain future for butter, efforts have been made to diversify dairy product manufactures. In this regard, the purification of butteroil and its utilisation in a number of new food forms have received much attention in the research programme.

The further improvement of quality of dairy produce has become an urgent need in order to retain and expand sales on a highly competitive overseas market. Laboratory quality control services have therefore been intensified to assist the industry in this objective.

New methods of retail merchandising, particularly in regard to cheese, have caused the industry to adopt changes in presentation and packaging, and technical assistance has been given.

RESEARCH

Priority in investigational work was given to new projects approved under the Research and Promotion Grant for Dairying, but other projects have also been continued.

Flavoured Butterfat Spreads

With a somewhat uncertain future for butter and increasing competition from substitutes, new uses for butterfat have been examined. Flavoured butterfat spreads with good keeping quality have been produced and have proved suitable for use as cake-fillings, toppings and frostings (Plate 47). The recombined products could be put to many uses in tropical areas, western Queensland and south-east Asian countries, where milk products are not readily available and where there is a deficiency of milk protein.

Good quality, high-fat-content products have been consistently produced and lower butterfat contents are now being tried with a view to reducing costs. In manufacture, best use is made of purified butteroil, skim-milk powder and buttermilk powder. A keeping quality of at least six months without refrigeration is envisaged.

Various methods of processing were tried with improvised equipment (Plate 46), homogenisation at various temperatures and pressures, different types of stabilisers and products of different composition. The critical levels for fat and solids-not-fat in such products were determined for satisfactory whipping ability. Critical temperatures of heating and cooling the mixes for good texture and convenient packing were also examined. Temperature tolerances for whipping were widened by adjustments in composition. Efforts are now being directed towards shortening the process, reducing costs and improving the texture of the product.

The methods developed were also used successfully for the production of flavoured milk drinks, ice cream, sweetened condensed milk, shortenings and cake-mixes. Several methods of packaging are now receiving attention. The products should have a good appeal to consumers, and commercial firms have shown an interest in their marketing both locally and for export.

Removing Weed Taint from Butterfat

Weed taints in dairy produce are a serious problem in Queensland during autumn, winter and spring and their prevalence is increasing each year. Efforts to reduce weed taint during processing have proved fruitless.

Previously held views that the weed taint in dairy produce was "locked" in the fat are now considered to be erroneous. Trials indicated that some weed taints are loosely linked to the fat globule membrane substances. As a result, methods for removing weed taints from butterfat were investigated. One method of extraction is partly chemical and partly physical. Another method is purely physical. Various techniques aided by centrifugation were tried with success. Such equipment is shown in Plate 52.

Very fine separation aided by neutralising compounds and a "salting out" technique were found necessary. Some further refinements of these methods are to be tested during the coming weed season. Efforts are also being made to shorten the process for greater economy. In the meantime, prevention of weed taint in milk and cream on the farm is also under investigation. In this regard, farm control measures are being examined to discover other practical ways of reducing weed taints.

A preliminary paper covering some aspects of this work was prepared for publication.

Improved Butter Flavour by Cream Culturing

The *per capita* consumption of butter in recent years has declined and investigations were continued with a view to increasing consumption by producing a more attractively flavoured butter.

The enhanced flavour of butter made from cream to which starter culture is added has proved popular with overseas consumers. The promising results obtained last year with experimental export consignments to the United Kingdom suggested an extension of this work. This year, the investigations centred on developing improved starter strains based on their rapid production of flavour and aroma with limited acid development. In this regard, promising new cultures were isolated and these are now under trial. It was also shown that by propagation in buttermilk rather than skim-milk a bulk starter of excellent quality can be produced. Buttermilk is more convenient than skim-milk for starter propagation in Queensland butter factories. Five factories are now co-operating in the trials.

To further enhance flavour and facilitate ripening, additions of large percentages of buttermilk starter (up to 10 per cent.) are being tried. Optimum levels of acidity in ripening for best flavour in butter are being assessed and the work extended to the production of a salted, cultured butter.

Because of the loss in flavour of cultured butter due to salting and possible detrimental effect on keeping quality, different types of salt and salt concentrations are being examined. Levels of 1-1.3 per cent. of carbonated salt proved superior to untreated salt or buffered phosphate salt at the same concentration.

The technique was considered to have application for the improvement of quality of cream for butter manufacture and this proved to be so. In a limited number of trials, first grade cream was raised to choice grade butter.

The grading results on export consignments of cultured butter received in the United Kingdom showed that the quality was satisfactory and that the keeping quality was maintained at a high level. Overseas buyers have been impressed by the product. However, a stronger lactic flavour is being sought.

Low Solids-not-fat in Milk

Wide seasonal variation in the compositional quality of milk, and particularly in the solids-not-fat content still occurs in Queensland.

Difficulty in producing milk of legal standard in both fat and solids-not-fat makes late winter and early spring a worrying time for many dairy farmers. It was shown previously that the problem stems from poor nutrition caused by the gap between winter and summer pastures and crops.

Trials using identical twins and the low-testing cows of a commercial dairy herd over three lactations showed the importance of a properly balanced concentrate-roughage diet in maintaining the level of fat and solids-not-fat. By steaming-up the cows one month prior to calving and feeding throughout lactation a ration containing lucerne hay, concentrates and some minerals, in addition to normal grazing, yields were doubled and the solids-not-fat percentage of milk raised. Some grade cows yielded over 1,000 gal. of milk per cow per lactation on such rations. However, the method is considered costly and more economical methods are being tried. The effect of steaming-up cows one month before and one month after calving is now receiving attention.

As adjustments in the acidity of the rumen of the cow have an effect on the bacterial flora and subsequent digestibility of certain rations, the effect of including small quantities of acetic and other acids in the rations is being determined.

In milk-producing districts the provision of improved grazing, such as lucerne, over two lactations raised the solids-not-fat percentage of milk and particularly the casein levels.

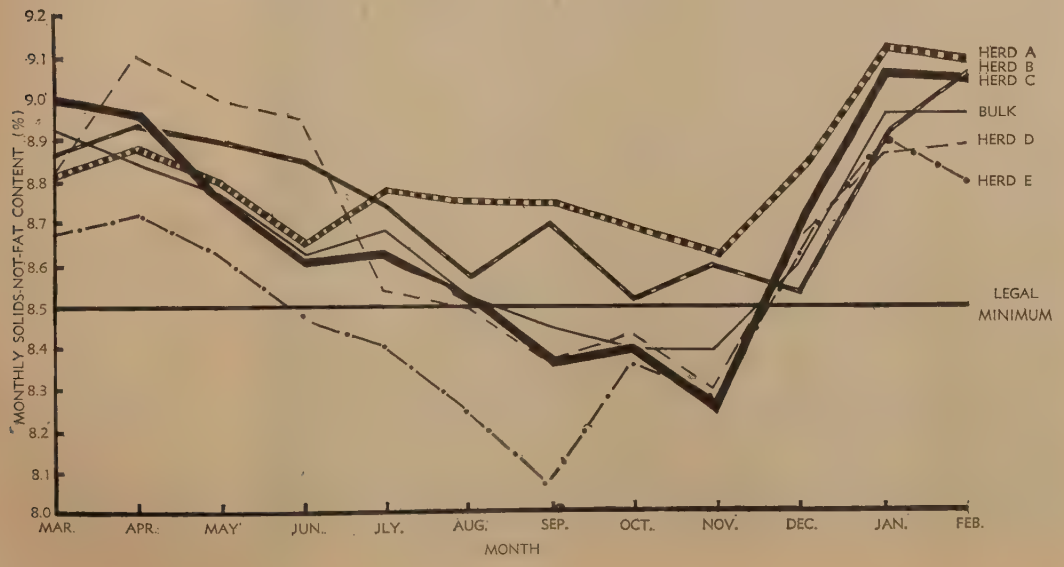
The overall results show that, provided adequate feed is available to the herd, the fat and solids-not-fat percentages can be maintained above the legal standards for the whole year. One paper on this work was prepared for publication.

Thermoduric Organisms in Market Milk

The testing of milk for thermoduric bacteria has already shown its value in the improvement of milk quality. Research work has indicated that the methylene-blue test is not a measure of numbers of bacteria surviving pasteurisation and correlates poorly with the bacterial counts resulting. The methylene-blue test is also greatly affected by storage conditions of the milk subsequent to production and would seem to be more a measure of atmospheric temperature than conditions of milk production on the farm.

Consequently, a system of testing for thermoduric bacteria was evolved and this system has been applied to the methods used by milk treatment plants as they have established their own laboratories (Plate 49).

The influence which this work has had in reducing bacterial counts of pasteurised milk is shown in the accompanying diagram (Figure 1). It will be seen that over a 4-year period, the number of milks with counts in excess of 300,000 per ml. decreased from more than 50 per cent. to fewer than 10 per cent. At the same time, the percentage of milks with counts from 50,000 to 100,000 per ml. increased from almost nil to approximately 25 per cent. In addition, during the last year some 5 per cent. of milks complied with the standard



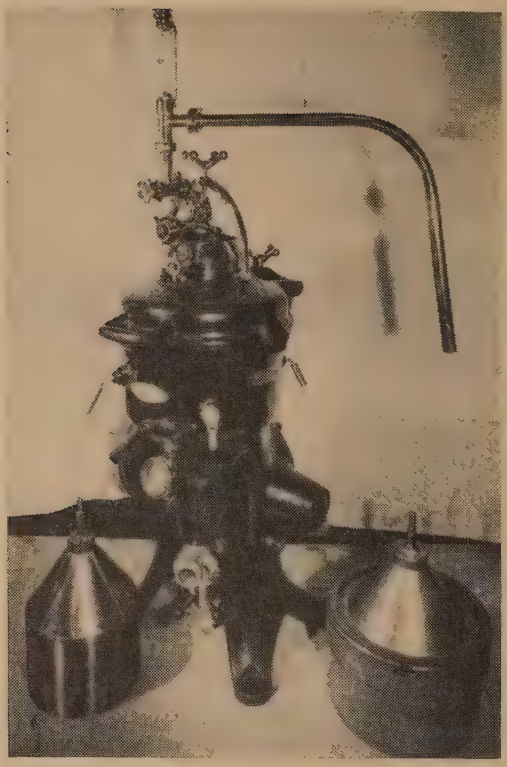


Plate 52.—Equipment used for the removal of weed taint from butteroil, a project developed by the Dairy Research Laboratory.

Plate 53.—Bitter cress, or swine cress, ranks as one of the State's worst milk-tainting weeds.

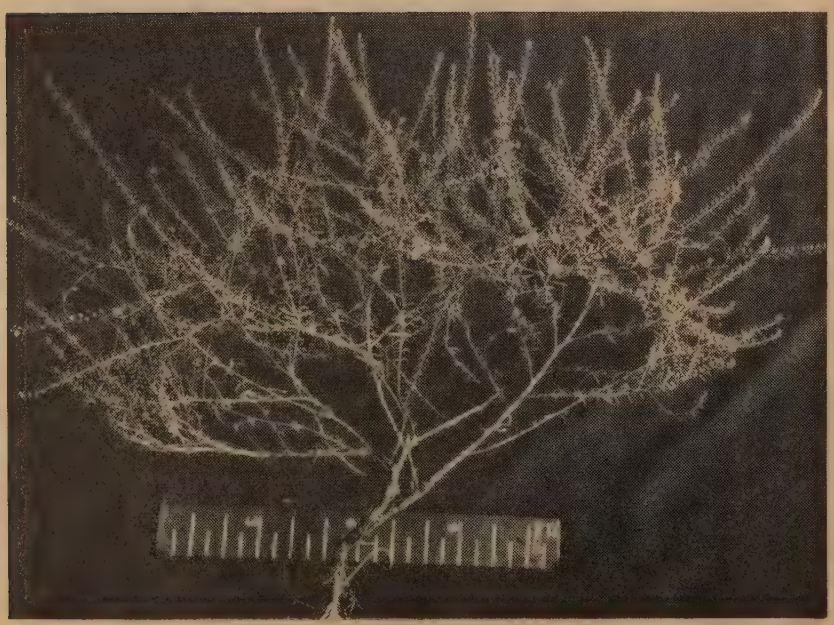


Plate 54.—Pepperwort is responsible for much tainting of milk.

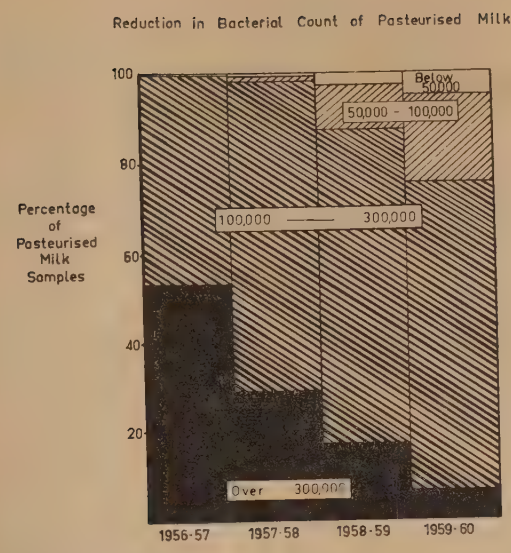


Fig. 1.—Diagram showing Improvement in Quality of Pasteurised Milk.

of 50,000 or fewer organisms per ml. Another import ant feature of the results has been the improvement in keeping quality imparted to the pasteurised milk by the reduction in bacterial count.

The work has laid the foundations for the develop ment of a more satisfactory grading test for market milk based on its bacteriological content, and further investigations are proceeding in this regard. Two papers were prepared for publication.

Keeping Quality Test for Pasteurised Milk

A modified keeping quality test for pasteurised milk was evolved to suit the warm climate of Queensland This test has been practised for more than a year and has given very good results. The test involves the incubation of the sample of pasteurised milk for 21-24 hours at 20 deg. C., followed by a methylene-blue test. The temperature and time of incubation must be strictly controlled using a methylene-blue reduction time of 2 hours as a standard. This modified test has been effective in discerning milks which are of poor bacteriological quality and which will not keep satisfactorily under Queensland conditions. At the same time, the test is not unduly stringent, as shown by the fact that the greater proportion of milks have satisfied the requirements.

Changes in Whey-Protein of Milk

The value of electrophoretic techniques for the determination of abnormal chemical changes due to udder disorders, effect of pasteurisation, refrigeration and intensive processing is being examined.

It was found that the most consistent and obvious change in the whey-protein pattern of milk from mastitic udders is the appearance of a fraction migrating at the rate of blood serum albumen. Increases in the amount of the immune globulins were also noted. Blood serum albumen in whey, by this method, would appear to be a reliable indicator of inflammation and hence mastitis.

The technique is also being used to determine the possible effects of Queensland's intensive milk and cream processing on the flavour of dairy produce.

Antibiotics in Milk

Penicillin and other antibiotics are widely used as preventive measures against udder disorders. Residual antibiotics left in milk can seriously affect cheese manufacturing procedures, resultant cheese quality and milk grading tests. As the request of the Health Department, a survey of penicillin in bottled pasteurised milk was carried out. Using the disc-assay method with a sensitivity of 1 unit of penicillin per ml. no instances of residual antibiotics were detected in 832 samples of bulk raw or pasteurised milks. Investigations on the recovery of penicillin from individually treated quarters of cows show that, as a rule, penicillin in measurable quantities persists in the milk from 24 to 48 hours and that the bulk of penicillin is to be found in the strippings.

The work has been extended in an endeavour not only to study the existing methods for the detection of traces of antibiotics in dairy products but also, when these tests prove of insufficient sensitivity, to devise a test suitable to the circumstances involved.

Promising results were obtained in the development of a biological test requiring 18-21 hours to perform. It has not been possible to obtain a short, rapid test of sufficient sensitivity. However, more sensitive chemical and biological methods are being sought.

One paper on this work was prepared for publication.

Surface Defects of Cheese

The most serious surface defect occurring in Queensland cheese is moulding, a problem which has assumed greater importance with the widespread covering of cheese in waxed and plastic coatings. Some work has already been carried out on the suppression of mould growth appearing under the waxed surface of cheese. By the use of fungicides, the incidence of this mould growth was greatly reduced under circumstances which were most favourable to moulding.

The work is being extended and orders have been placed for equipment to continue the trials. Emphasis is being given to methods designed to prevent the building-up of mould populations in curing rooms by the more effective control of humidity, and the holding of cheese for short pre-drying periods prior to waxing. The relative humidity in many cheese-holding rooms is far too high. It has been found essential to hold cheese at 68-70 per cent. relative humidity during a short pre-drying period prior to waxing, if intense mould growth is to be avoided. In addition, various types of fungicides incorporated in waxes and plastic coatings are also under trial.

As further preventive measures, improved cheese shelving and the use of ultra-violet light are also being examined. Six factories are co-operating in this work.

Fermented Cheese

There was an increased incidence of fermented cheese over the past two years. This flavour defect was accentuated at times by poor cheese manufacture, low acidity production due to poor starters, phage contamination and high moisture, but the defect also occurred in some cheese of quite good manufacture. It has been shown that the defect is due to fermentation produced by species of *Micrococcus*—bacteria which originate in the udder and develop on milk equipment.

Microscopic examination of large numbers of cheese showed that in almost all instances of fermented flavour the starter population of the cheese almost entirely disappeared at three weeks of age. As a consequence of this, attempts were made to study the many and varied factors which could bring about such a result. In a number of instances very slow acidity production by starters in some farm milks was shown to be due to traces of residual antibiotics. The antibiotic involved was not penicillin. Broad spectrum antibiotics such as tetracyclines inhibit starter strains at very low concentration. The sensitivity levels of various starter organisms for various preservatives and antibiotics were provisionally determined.

Inhibitory Properties of Milk

Inhibition of starters in milk is sometimes due to phenomena other than bacteriophage, but the causes are not clear. The problem has been studied from several angles, including the effect of creaming of milk, the serological properties of milk, the effect of partition and the mode of manifestation of various factors involved in inhibition. It would appear that both skim-milk and cream fractions donate factors which separately cause some degree of inhibition of acidity production, but both factors are required for maximum inhibition.

Three papers have been prepared for publication, viz. "The role of the fat globules in the inhibition of certain strains of *Streptococcus cremoris* in pasteurised milk";

"The serological properties of milk and their role in regard to the inhibition of certain strains of *Streptococcus cremoris*"; and "The value of the methylene-blue dye reduction test in studying natural inhibitory properties of milk."

Cheese Packaging

The pioneer work in Australia on the improved packaging of cheese in plastic materials was done in Queensland and the success of the method and the wastage saved by eliminating rind formation encouraged the rapid growth of the packaged rindless cheese trade. Eleven Queensland factories now manufacture and pack rindless cheese and their sales are steadily increasing. Six factories are also co-operating in the preparation of experimental consignments of rindless cheese for export. Very good reports have been received concerning Queensland rindless pre-packaged cheese exported to the United Kingdom and the expansion of this trade seems assured. However, occasional problems arising in connection with the packaging of rindless 40 lb. cheese for export have been investigated. Defects under examination include mould growth, pink-veining and fluid exudation.

Mould growth is invariably associated with defective sealing of the packaging film. Pink-veining was shown to be due to the growth of a yeast. Exudation of moisture with gas production was most usually associated with undesirable sporing rods and micrococci in the surface flora of cheese. Investigations are continuing.

Cheese Waxing

All cheese, whether for local or for export purposes, is now waxed and its appearance thereby improved. Further commercial trials of a waxed blend of petroleum jelly, hard paraffin and microcrystalline in the proportions 1: 2: 3 confirmed its general suitability. As a result, shattering and cracking of the wax has been reduced and the coating withstands more severe handling.

Non-cheddar Cheese Varieties

Appreciable quantities of non-cheddar cheese varieties which attract good prices are imported into Queensland from overseas countries. Consequently, investigations into the manufacture of non-cheddar varieties of cheese were continued. Special equipment was made for use in trials, and experimental work on the manufacture of several varieties is in progress at a number of factories. Emphasis is being given to improvement of techniques and an expansion of the manufacture of Edam and Gouda cheese. Further development of methods for the production of high-acid cheese of the Cheshire type, employing a stirred curd technique, was planned and in this regard some modification of equipment has already taken place. From the preliminary work carried out on non-cheddar cheese varieties there is little doubt that some types can be produced in Queensland.

Mechanisation of Cheese Manufacture

Endeavours were made to reduce the labour requirements in cheesemaking and to provide greater technical control of the process of manufacture.

Some equipment was ordered to allow for trials of semi-mechanical cheese making based on stirred curd techniques. This equipment includes a pH recorder unit which may be used as a controlling device in the triggering-off of the various stages in cheese manufacture. Provision was also made for expenditure on a special type of mechanised cheese vat. It is hoped that some progress may be made with the mechanisation of the production of pressed-curd types of cheese such as Edam and Gouda.

Butterfat Content of Skim-milk

The Queensland Dairymen's Organisation sought advice on the butterfat content of skim-milk from farms. However, little is known of the extent of fat losses in separation and a survey was planned with this object in view. From field data obtained, it will be possible to determine the efficiency of separation under farm conditions, and the factors causing variable, high or low fat losses.

Improved Detergent-Sanitisers

Queensland's tropical and subtropical conditions demand more exacting requirements in the cleaning and sterilizing of dairy equipment in order to maintain the quality of milk and cream and to help control thermoduric bacteria in market milk supplies.

A cheap non-corrosive detergent is available which may be ideally suited to Queensland's hard and difficult water supplies. The product is now being tried on 40 farms with promising results. Two new chemical sterilants tried in comparison with chlorine compounds gave good results and an extension of their use is planned.

While the benefits and convenience of a combined detergent-sanitiser in cold solutions are appreciated, none has yet proved satisfactory in practice. One under trial at present shows some promise but modifications in practice are necessary, particularly a soak between milkings for the rubberware. One paper on this work was prepared for publication.

Farm Refrigeration

There is an increasing awareness by farmers of the necessity for farm refrigeration if quality of milk and cream is to be maintained and improved in our warm climate. However, refrigeration is costly and efforts to develop cheaper types were continued.

Trials with electrically operated drop-in condensor units in farm-built concrete tanks gave good results. Similar units are now being planned for operation from the milking machine engine. The use of a cheap prefabricated cabinet with drop-in condensor unit also proved satisfactory.

Although all five units under trial are immersion types, in no instance has corrosion of the can or cabinet occurred. A simple, cheap technique of water treatment was evolved to overcome such problems. The units have been used successfully for the refrigeration of both cream and milk. Operational costs for the units range from ½d. to ¾d. per gal. of milk and from 2d. to 2¾d. per gal. of cream.

For further economy, trials with low-priced, reconditioned compressors with coils in farm-built tanks have been planned. As the farm pick-up of bulk milk is likely to develop, a cheaper type of bulk milk refrigerator on the farm has been considered. In association with the Butter Marketing Board, a bulk milk refrigerator (Plate 50) was tested. Some further modifications are necessary to adapt this unit for bulk cream holding on the farm.

Improved Dairy Rubberware

Dairy rubberware has been found responsible for serious contamination and trials were continued with types designed to reduce such contamination. Several new plastics and synthetic rubbers are being tried and some give promise of overcoming the disadvantages of natural rubber.

Controlled Ripening of Cream on the Farm

The proper ripening of cream at the right temperature could aid greatly the improvement in quality of cream and butter under Queensland's tropical and subtropical conditions. Raw creams, inoculated with various types of cultures and incubated at approximately 65 deg. F. for ripening, have improved cream quality. In some instances, the improvement was great enough to raise the quality of cream from second grade in the uninoculated control to choice in the cultured sample. Methods are now being evolved for simplifying the carrying of the cultures by farmers without the risk of contamination.

Dairy Factory Water Supplies

Queensland's hard and difficult factory water supplies exert a tremendous influence on the quality of dairy produce and affect routine factory operations of cleaning and sterilizing. Existing methods of treatment have variable effects. Many systems of treatment add hardness and by chlorination increase corrosion of equipment. Many untreated waters, on the other hand, corrode equipment, increase cost of detergents and add to fuel costs.

Many factories use incompatible detergents with water supplies. By analysis, laboratory trial treatments and eventually larger scale factory trials, it is possible to devise methods of treatment to render factory water supplies chemically and bacteriologically satisfactory. This year 137 water samples were so examined.

To assist the purification of waters bacteriologically, two methods are under trial, viz. ultra-violet sterilization and use of an iodophor preparation. Both are giving promising results, and neither shows the corrosive effects of chlorine. Costs in relation to chlorine are also being compared.

Casein-digesting Bacteria

The significance and importance of the casein-digesting bacteria in butter have been investigated and the results prepared for publication.

LABORATORY QUALITY CONTROL SERVICES

The laboratory quality control services play an important part in Branch work. During the year over 50,000 samples of milk, butter, cheese and other dairy products were submitted to almost 100,000 tests.

Butter

A total of 23,477 chemical and bacteriological tests was performed on 2,361 samples. Moisture and salt determinations of 2,169 samples revealed only 19 or less than 1 per cent. overmoisture. The average chemical composition was moisture 15.63 per cent.; salt 1.34 per cent.; curd 1.00 per cent.; and fat 82.03 per cent. The production of butter conforming more closely to the export standard of 80 per cent. butterfat would make for greater economy in manufacture. The mean pH value of 1,284 samples examined was 7.61.

An outstanding improvement in the bacteriological counts of butters has occurred, the bacteriological quality index of 333 out of a possible 400 being the highest so far achieved. The installation of modern equipment, particularly stainless steel churns, was mainly responsible for the improvement.

Microscopic examinations for the size and distribution of the water droplets were performed on 2,183 samples to check the standard of working. There was a decline in the numbers classified as "well worked".

Following successful experimental work for improved cream filtration techniques last year and their widespread acceptance by the industry, extraneous matter in butter has ceased to be a problem. However, the effect of the techniques on fat losses in churning is still under examination. The results of examination of 2,156 samples show that a high standard of cream filtration is being maintained.

Twenty-five bacteriological surveys were conducted at factories in order to investigate problems associated with butter quality and the efficiency of factory processing. Excesive fuel consumption at three factories is under examination and flue gas analyses were initiated.

Cheese

Services provided to the cheese industry included advice on manufacturing problems, analyses of samples, the carrying out of surveys and the provision of starter cultures and their control.

A total of 1,411 cultures was distributed to commercial cheese factories. Three new starter strains from overseas were also introduced into the service.

In the course of 17 surveys it was found that the most important cause of bacteriophage trouble in factories is insufficient cleansing and sterilizing of equipment. Other important causes are contamination of the water in the starter tub and of mother starter cultures.

Trials with an iodophor as a chemical sterilant proved promising in the control of bacteriophage at factories.

Table 1 shows the average composition of cheddar cheese based on 195 samples examined.

The results show a continuance of the improvement in the composition of cheese which has been apparent in recent years.

Some 44 per cent. of the 100 samples examined for extraneous matter were classified as "dirty". There is still much room for improvement even though the results are better than last year's.

Wherever possible, use has been made of conferences, meetings, lectures and demonstrations in order to make contact with as large a number of factory personnel as possible at the one time, with a view to raising the general level of technological knowledge throughout the cheese industry.

Market Milk

The quality control of market milk and table cream on a State-wide basis was continued. Increasing attention was given to the testing of raw milk supplies for counts of thermoduric organisms. Details of samples examined, together with relevant data for the preceding year, are set out in Table 2.

TABLE 2

SUMMARY OF MILK AND TABLE CREAM EXAMINATIONS

—	1958–59	1959–60
Bottled pasteurised milk—		
Plate counts	1,691	1,646
Over 100,000 per ml.	1,004	640
Coliform tests (10 ml. and 1 ml. levels)—		
Number	3,272	2,774
Percentage positive in 1 ml.	12·6	10·5
Phosphatase tests—		
Number	1,587	1,561
Percentage positive	·06	..
Keeping quality tests—		
Number	972	773
Percentage failure	·1	·9
Fat tests—		
Number	1,691	1,310
Average percentage	3·9	3·8
Solids-not-fat tests—		
Number	1,595	1,305
Average percentage	8·7	8·6
Freezing point tests	1,419	810
Factory surveys	67	34
Raw Milks—		
Raw Milks from country depots—		
Methylene-blue tests	7,691	291,431
Fat tests	7,788	122,413
Bulk tanker samples tested in laboratory—		
Methylene-blue tests	555	790
Fat tests	579	808
Raw milk vendored—		
Methylene-blue tests	315	244
Fat tests	311	244
Thermoduric counts on raw milk	9,483	3,897
Microscopic examinations	5,613	2,986
Bottled Pasteurised Cream—		
Plate counts	402	654
Over 100,000 per ml.	173	349
Coliform Tests—		
Number	433	1,020
Percentage positive in 1 ml.	47·6	19·9
Phosphatase tests—		
Number	416	530
Percentage positive	7·7	5·8
Fat tests—		
Number	378	538
Average percentage—Whipping cream	..	42·9
Average percentage—coffee or dessert cream	..	20·5
Total number of tests in Branch laboratories	46,191	54,816

TABLE 1

AVERAGE COMPOSITION OF CHEDDAR CHEESE

Year	Moisture	M.F.F.S.	Fat	F.M.F.S.	Salt	S.M.
1957–58	37·6	55·2	31·9	51·1	1·6	4·3
1958–59	36·4	54·7	33·4	52·5	1·6	4·5
1959–60	35·4	53·5	33·8	52·3	1·6	4·6

M.F.F.S. = Percentage moisture in the fat-free substance.
F.M.F.S. = Percentage fat in the moisture-free substance.
S.M. = Percentage salt in moisture.

A total of over 400,000 methylene-blue and fat tests was carried out on raw milks by factories. There was little change in the percentage of milks failing the 4 hr. methylene-blue standard (2.5 per cent., compared with 2.2 per cent. during the previous year). The number of methylene-blue tests carried out on bulk, raw, chilled milks received from country chilling factories greatly increased to accommodate the ever-increasing proportion of city milk received in this manner. There was an improvement in the chemical composition of raw milk, as reflected in the low percentage (1.6) failing the 3.3 per cent. fat standard, compared with 2.6 per cent. for the previous year.

The amount of raw milk being sold by vendors is steadily decreasing and only 244 samples were tested.

The use of the count of thermoduric organisms as supplementary to the methylene-blue test in improving the quality of raw milk supplies intended for pasteurisation has become firmly implanted in the milk quality control programme, and 3,897 milk samples were examined for these organisms. In addition, tests for thermoduric bacteria were carried out in factory laboratories. This work has been of benefit in improving the quality of both raw and pasteurised milk.

Pasteurised milk was efficiently treated, as no positive phosphatase test was recorded and only 0.9 per cent. failed to pass the keeping quality test.

The chemical composition of milk was well maintained. The average fat content was 3.8 per cent. and the solids-not-fat 8.6 per cent.

A close check was maintained for any evidence of adulteration with added water and a total of 2,193 freezing point determinations was made.

Analytical

A total of 9,318 samples was submitted for examination. The analyses involved the performance of 18,500 individual tests. Where samples did not conform to the desired standards of composition, advice on remedial measures was given.

Dairy Glassware

A total of 7,771 pieces of glassware was tested. The percentage rejected for non-compliance with standards under the Dairy Produce Acts was 7.5. Efforts now being made toward the adoption of an Australia-wide standard for Babcock testing of dairy products have as their objective accuracy in testing and uniform quality dairy glassware for use in all States.

PUBLICATIONS, ETC.

Fourteen research and advisory papers were prepared for publication. Twelve radio talks were given, 20 addresses were prepared for various purposes and 25 press releases were prepared.

STATISTICS

Table 3 summarises the wide range of tests performed.

TABLE 3

SUMMARY OF TESTS PERFORMED

—	No. of Samples	No. of Tests
Butter Improvement Service	2,361	23,477
Analytical	9,318	18,500
Analyses associated with various research projects	25,000	55,000
Quality control of market milk	46,191	54,816

STAFF

One officer qualified for a Master of Science degree on the submission of a thesis on "Inhibitory factors in milk." Two officers are studying for honours degrees in pure science. One of these officers was granted a scholarship by the Australian Dairy Produce Board under the research and promotion grant.

In order to keep the cheese industry abreast of developments in cheese technology and research, an officer spent four months in Europe and the United Kingdom. Much valuable information was obtained which should be of benefit to the cheese industry. The Cheese Marketing Board shared the cost and this gesture of self-help is commendable. The results of the officer's visit have been made known to the industry in addresses given and in a summarised report which was sent to all factories.

DIVISION OF MARKETING

The principal functions of the Division—viz. the development of organised marketing of farm products, the investigation of economic principles as applied to rural production, and the administration and determination of standards for agricultural requirements and farm produce—were fulfilled satisfactorily during the year.

The Committee set up in 1958 under the Chairmanship of the Co-ordinator General of Public Works (Mr. J. Holt) and including the Director of Marketing and representatives of the Brisbane City Council, growers and agents, as a result of investigations made into all aspects of municipal marketing of fruit and vegetables in Brisbane recommended that the city markets be re-located in the Rocklea area and that a Markets Trust be formed for purposes of establishing and maintaining a public market in the Area of the City of Brisbane for the sale and storage of fruit and vegetables.

The major undertaking in economics research was a survey of the wheat and associated industries on the Darling Downs conducted in collaboration with the Council of Agriculture at the request and expense of the State Wheat Board. The more important conclusions are set out in the report of the Economics Research Branch.

An economic investigation which is still in progress, into the problems of the dairying industry in the Wide Bay district, was undertaken at the request of the Wide Bay Dairy Extension Advisory Committee. In this project, close collaboration with officers of the Divisions of Plant Industry, Animal Industry and Dairying has proved essential.

Work was continued throughout the year on the development of farm budgeting procedures, the economics of soil conservation, and winter feeding studies on dairy farms.

COMMODITY MARKETING BOARDS

A detailed description of the activities of the various marketing boards operating in Queensland will, as in previous years, be given in the Annual Report of the Director of Marketing to the Minister in charge of the Department of Agriculture and Stock, as required by *The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1957.

Consideration was given to proposals by Queensland beekeepers for the setting up of a Honey Marketing Board. These proposals arose out of difficulties experienced in heavy production of good quality honey and low prices on the export market. These conditions were aggravated by the marketing in Queensland of honey produced in other States. Queensland beekeepers deferred further consideration pending the outcome of action being taken in New South Wales to establish a Honey Marketing Board in that State.

During the year the Branch was concerned with amendments to regulations under *The Primary Producers' Organisation and Marketing Acts,* both generally and with respect to particular marketing organisations. These regulations related, *inter alia,* to the conduct of elections of growers' representatives, to the conduct of board business with particular reference to the rescission of resolutions, and to the appointment of proxies at meetings of Local Dairymen's Branches.

Levy regulations under *The Fruit Marketing Organisation Acts* were amended in the case of pineapples and beans and extended in the case of citrus, tomatoes, pineapples and bananas.

Full details of these and other amendments to regulations will be given in the Annual Report of the Director of Marketing, referred to above.

AGRICULTURAL STANDARDS

As a result of discussions between representatives of the various States of the Commonwealth, agreement was finally reached for uniform standards to be adopted for apples, pears and potatoes. This is a progressive step towards organised marketing and will facilitate interstate trade in these commodities.

Steps were taken during the year at an interstate conference towards the introduction of uniformity in procedures of registration, specification and labelling of veterinary medicines and pesticides.

Due to a failure of the apple crop in Tasmania because of seasonal conditions, an opportunity was provided for Queensland growers to supply part of the deficiency in Australian export quotas. As a result, 86,662 cases were exported through the port of Brisbane and a further 34,205 cases were shipped through Sydney. This compares with the export of 29,604 cases last year. Standards Branch Inspectors provided the final wharf inspection for these shipments.

The inspection of agricultural requirements, which include seeds, agricultural chemicals, stock foods, etc., was concentrated towards distributing centres such as merchants' depots and the city railhead, and as a result, greater quantities of substandard and incorrectly labelled goods were intercepted. Further development of this service depends on the provision of additional transport facilities.

The quantity of certified seed produced has proved sufficient for local requirements of all crops included in the seed certification scheme, with the exception of buffel grass, where problems associated with mechanical harvesting and cleaning have not been completely solved.

The administration of *The Farm Produce Agents Acts* was transferred from Central Administration to Standards Branch in August 1959, and the Standards Officer was appointed Registrar.

The Fruit and Vegetables Grading and Packing Regulations, which had been out of print for several years and were proving deficient in some respects due to recent changes in market practices, were amended in certain particulars and additions made to them to enable certain actions which previously could only be taken under *The Diseases in Plants Act* to be taken under *The Fruit and Vegetables Acts.*

STAFF

The position of Assistant Director of Marketing was filled in March 1960 by the appointment of Mr. A. A. Ross, who previously occupied the position of Standards Officer. As a consequence, the Director of Economic Services was relieved of his remaining marketing duties, and this enabled him to concentrate on the development and direction of the new Economics Research Branch. The position of Standards Officer was subsequently filled by the promotion of the Assistant Standards Officer, Mr. A. C. Peel.

Two new position were created in the Division, viz. Senior Marketing Officer in the Marketing Branch and Senior Agricultural Economist in the Economics Research Branch, and Messrs. D. P. Lapidge and E. O. Burns were appointed to them respectively. The appointment to the Economics Research Branch during the later part of the year of three Agricultural Economists provided the nucleus of a permanent staff. Two of these appointees were formerly Marketing Officers who had been employed in this Branch on a part-time basis.

Mr. A. J. Hopsick was transferred from Accounts Branch and appointed Clerk and Inspector under *The Farm Produce Agents Acts,* and Mr. E. T. Prodonoff was seconded from Horticulture Branch for the purpose of understudying Mr. R. J. Holdsworth, Seed Analyst, prior to his retirement, to avoid any interruption in the services rendered by the Seed Testing Laboratory.

A promotion examination was held during the year for Inspectors, Standards Branch, at which two Inspectors (Markets) and one Inspector (Agricultural Standards) qualified for promotion from Division II to Division I.

As the result of an entrance examination for the appointment of Inspectors (Markets), three officers were appointed, one to fill the vacancy caused by the resignation of the Seeds Officer and two as Inspectors (Markets). An officer previously attached to the Agriculture Branch, and subsequently employed by the New Guinea authorities, was readmitted to the Public Service and appointed as Inspector (Markets). No vacancies now exist in the market inspection staff.

MARKETING BRANCH

MARKETING BOARD ELECTIONS AND REFERENDA

Ballots were held during the year for the election of growers' representatives for the usual 3-year term on the following boards—Atherton Maize, Barley, Butter, Cheese, Cotton, Egg (South Queensland) and Wheat. A by-election was held to fill a vacancy on the Northern Pig Marketing Board, caused by the death of Mr. J. Killoran, who had been a member of this Board since January 1950.

The operations of The Cheese Marketing Board and of The Egg Marketing Board (South Queensland) were extended until December 31, 1965, and December 31, 1971, respectively. In neither case was a petition received from the growers concerned to conduct a poll on the question of the extension.

Towards the close of the year an Order in Council was issued extending the operations of The Ginger Marketing Board for a further period to July 16, 1963.

PRIMARY PRODUCERS' CO-OPERATIVE ASSOCIATIONS

No new associations were registered under *The Primary Producers' Co-operative Associations Acts,* although a number of associations amended their rules to meet changing circumstances. The last new registration under the Acts was in 1957.

During the year an Order in Council was issued approving an increase from 5 per cent. to 7½ per cent. in the maximum rate of dividend on share capital which may be authorised by rules of an association for payment to its members. The maximum rate of 5 per cent., subject to any variation which might be approved from time to time by the Governor in Council, was fixed when the Act was first passed in 1923.

The decision to increase the dividend rate was made following representations by co-operative dairy associations that difficulty was being experienced in raising additional capital because of higher interest rates offer-

ing by other forms of investment. Since the Order in Council was issued only four associations have sought approval to amend their rules making provision for a dividend rate in excess of 5 per cent.

MARKETING INTELLIGENCE SERVICES

During the year the Branch published 41 crop forecasts and reports with a total circulation of over 24,000. These forecasts and reports were designed to provide reliable and up-to-date information on crops and markets for the general benefit of rural industry and associated business. The reports were supplied to farmers, financial institutions, merchants and business houses supplying growers' requirements, and were also mailed, on request, to overseas buyers of Queensland agricultural products.

Crop Forecasts were issued on 12 crops—wheat, barley, oats, linseed, canary seed, grain sorghum, maize, white French millet, setaria (panicum), peanuts, potatoes, and onions, a newcomer to the series. Quarterly reports were also issued on the poultry industry.

During the year the forecasting system was improved by widening the area covered and by the appointment of additional crop correspondents. The onion crop forecast necessitated the interviewing of prospective correspondents and their later appointment. The rapid development of agriculture in the outer areas such as the Western Downs, Dawson, Callide and Central Queensland Highlands resulted in a continually changing crop picture to be covered by the forecasting system. This will necessitate further investigation in the coming year.

The system of forecasting in use continued to rely largely on Honorary Crop Correspondents who furnished specific information on the state of crops in their localities. The selection of correspondents from farmers in each area, based on a grid sampling technique, ensured a complete coverage of the districts where any particular crop is grown. The selection of correspondents has not yet been completed and it was evident that further appointments were necessary. Some 600 farmers co-operated in the work of crop forecasting during the year.

Monthly *Reports on Production Trends* giving a picture of the state of the agricultural, pastoral and dairying industries in Queensland were published, thereby providing a summary of all forecasts previously issued, as well as information on crops and livestock not covered by the forecasting service. In this way particular attention was drawn to highlights in Queensland agriculture during the month.

The monthly *Grain Abstracts* continued to be well received by farmers. This publication provides an up-to-date picture of the overseas market situation in regard to grains and seeds, also information on oil crops and other factors affecting these crops. The reports were drawn upon by most newspapers circulating in grain growing areas.

The regular issue of daily and weekly market reports was continued. The daily reports are issued within a few hours of the close of sales, and the information therein is broadcast daily in the A.B.C. "Country Hour" and by other radio stations as well as being disseminated by the press and this Department.

The demand for marketing intelligence services generally continued to grow. This is in part due to the more difficult marketing conditions being experienced by many rural industries, but it is also the result of increasing recognition by farmers and associated business enterprises that reliable and timely information is as important in agriculture as it is in other fields.

In addition to these regularly published reports and forecasts the Branch was called upon to supply a wide variety of information on agricultural marketing and economic problems. This included estimates of total rural income and likely changes in the volume of rural production, and trends in particular industries, as well as information in response to particular enquiries by marketing boards, farmers, banks and businesses.

Officers of the Branch delivered three radio talks and submitted two articles for publication in the *Queensland Agricultural Journal.*

ECONOMICS RESEARCH BRANCH

INVESTIGATIONS

Wheat Survey

The major undertaking during the year was an economic survey of the wheat and associated industries on the Darling Downs. The report of this investigation was published at the close of the year. This survey was commenced in 1958 in collaboration with the Council of Agriculture at the request of the State Wheat Board, which met the travelling expenses involved and the cost of printing the report.

In requesting the survey, the Board had regard to the considerable changes that have occurred in the pattern of farming during the post-war period arising from the extensive development of mechanisation, far-reaching technological advances, and the changes in the market prices and prospects of many farm products associated with growing wheat under Queensland conditions. These changes can have a considerable influence on the policies of the wheat industry and there was a clear need for an analysis of the situation in the industry, and also for more facts than were available either to the Board as a whole or to industry leaders generally.

The survey was oriented particularly towards variations which occur in costs and returns under the different conditions in which wheat growing is carried out. These differences include those of geographic location, farm size and type of farm. The report clearly indicates how much variation there is in growers' problems under the diverse range of conditions which exist.

It is pleasing to report that ready co-operation was received from wheat growers and others associated with the industry, public accountants, bankers, business firms and so on. Few farmers hesitated, and then for sound and understandable reasons, to assist to the utmost to enable the officers to gather a vast array of facts and data. This material is of course confidential as between the officer and the farmer, but in the analysis the information has been grouped in such a way as will not disclose the details of individual farms but permit general conclusions to be reached.

Information was collected from a stratified-random sample of 166 growers by personal interview using a prepared questionnaire. Income and cost data were obtained from copies of the farmers' income tax returns for the three years 1955-56 to 1957-58. These were obtained during the farm interview in some cases, but generally from the farmers' Tax Agents, on authority from the farmers.

Field work, including travelling time, farm interviews and collecting taxation information, occupied 172 man-days, and an additional 400 man-days were required for subsequent computations, analysis and preparation of the report. Assistance was given by a sub-committee of the State Wheat Board in providing basic statistics on which to base the sampling procedure, and at a later stage in clarifying points which arose during the analysis of the survey data. Time devoted by clerical staff of the State Wheat Board in producing the basic statistics is additional to that mentioned above.

A major part of the report is devoted to an analysis of the factors which influence profitability on wheat farms. A number of variable factors, such as area of cultivation, capital investment, income from supplementary pursuits, level of costs and labour force, were studied separately, and an attempt made, largely by tabular analysis, to gauge the effect of variations in each factor on the overall farm economy.

One of the most important features of this survey is the clarification it gives to necessary lines of investigation regarding the maintenance of soil fertility. It is obvious from the survey that a good deal of work is needed on the relationship between soil types, farming patterns and costs and returns. Much more detailed knowledge regarding the location and influence of soil types is a prerequisite to this work, in which both short-term and long-term considerations are important.

Dairy Surveys

As indicated in last year's report, proposals for an economic investigation into certain problems of the dairying industry have been developed and a survey was commenced in the Wide Bay district during the later part of the year following the completion of the field work of the wheat industry survey. The dairy industry presents a problem to the research worker because the purely economic approach is clearly not a sufficient guide for policy making on the farm, industry or Government level. An analysis of the situation on many farms where the general level of net return is low, based solely on accounting or economic concepts, does not provide a satisfactory description. In isolating economic factors therefore it is vital to realise that these do not tell the whole story or even, in some instances, the really important part of the story. Psychological and sociological factors exert strong influences in this industry and any approach which ignores them is likely to lead to false and dangerous conclusions.

In the work being undertaken by the Economics Research Branch the keynote is a concentration of effort in detail on restricted areas and a limited number of farms. This has been made possible by the enthusiastic co-operation of Dairy Extension Advisory Committees, notably those of the Wide Bay and the Eastern Darling Downs.

In particular, the objects of the present survey are to analyse the influences of farm practices, such as fodder cropping, fodder conservation, pasture improvement, irrigation, hand-feeding, herd testing, etc., on the costs structure and the returns available from the farm business, and to determine the extent to which the costs of techniques for improvement now recommended by the Department can be minimised.

The Wide Bay Committee has selected a panel of farmers who have agreed to co-operate in the survey. The 50 farmers concerned are located in the area stretching from Tiaro in the north to Maleny in the south and extending westward to Kilkivan, and include straight dairy farms which produce butter or milk or both as the sole enterprise as well as mixed farms which combine agricultural and horticultural crops with dairying.

A major feature of this survey will be the close collaboration necessary between the investigation teams and the various officers of the Divisions of Plant Industry, Animal Industry and Dairying who are connected with the farmers of the area. It will be essential to have the fullest possible information concerning practices that it would be technically practicable to adopt on each of the farms being studied.

A close analysis is to be made of the alternative courses of action that are open to the individual farmer. These alternatives necessarily depend upon the inherent potentialities of the farm, the techniques available, and last but by no means least, the farmer's own personal and family circumstances in respect of such matters as capacity, health, age, education, personal preferences and so on. Each of the alternatives has to be clearly defined by consultation between farmer, field officer and economic investigator and the costs of each worked out by a budget procedure and compared with the returns that might be expected. With information of this kind as related to typical farm situations in a district, both farmer and extension officer would be more effectively guided. For instance, such an analysis could show whether and to what extent the dairy enterprise should be developed, or whether some other part of the farm business should be examined to explore potentialities for increased total income.

An investigation was initiated last year in collaboration with the Cattle Husbandry Branch with the object of determining the costs and returns associated with the production of wholemilk during the winter months on an intensive supplementary feeding basis.

Dairy production in south-eastern Queensland is based primarily on pastures with some forage cropping, which results normally in a pattern of high summer output alternating with low winter output. Considerable modification of this pattern is required to maintain the capital city's liquid milk requirements during the winter months. This is achieved by placing milk suppliers on a daily quota during the summer months of normally flush production, based on the volume of milk supplied during certain months of the winter.

A group of milk suppliers in the Beaudesert district co-operated by keeping detailed records relating to production, feeding, labour use, costs and returns for a period of 12 months. Analysis of these records was delayed for some months because of the heavy demands which the wheat survey made on a limited staff, but this work has now been completed and a report is in course of preparation. It is proposed to supply each co-operating farmer with an analysis of his own farm, which he can compare item by item with the generalised findings of the investigation. This will indicate to him in which respects his efficiency may be greater or less than the group average.

Soil Conservation Economics

This is a long-term project being conducted in collaboration with soil conservation officers of the Agriculture Branch to assess the economic worthwhileness of soil conservation practices. Such assessment is very difficult and the experience of investigations in other countries, such as the United States and South Africa, and in other States of the Commonwealth is not conducive to undue optimism as to the possibilities of firm conclusions being reached. The project is, however, worthwhile because valuable data of interest to soil conservationists and farmers can be obtained only in this way. Here again the maintenance of farmer co-operation in the absence of quick results can be a problem.

Budgeting Procedures

Good progress was made with this investigation and the experience gained was invaluable in designing the dairy industry survey.

The demand by farmers for personal assistance in drawing up partial budgets for alternative lines of development is growing at a greater rate than can be handled by the present staff. One difficulty in this work is the scarcity of physical input-output data under Queensland conditions. This weakness was recognised when this Branch was first formed, and the task of collecting and collating data from which to derive standard measures is being continuously pursued on a part-time basis.

It is proposed to compile a booklet setting out various aspects of record keeping on farms and the essentials of budgeting, together with the collected farm data and input-output relationships that have been obtained as a result of this work.

GENERAL

The filling of vacant positions in the Marketing Branch enabled the relief from marketing duties of the Director of Economic Services to be completed, so that concentrated attention can now be given to the development of the Branch and the investigations into farm economics that have become of increasing importance in the light of changes now coming over the farming scene.

The appointment to the Branch during the later part of the year of three Agricultural Economists provides the nucleus of a permanent staff. Two of these appointees were formerly Marketing Officers who had been employed in the Economics Research Branch on a part-time basis.

A major task is the securing of staff for the Branch and, in view of the demand for men trained in agricultural economics work, this will mean emphasis has to be given to the training of graduates from either Commerce or Agriculture faculties who have a leaning towards the specialised work of farm economics investigation.

STANDARDS BRANCH

All sections of the Standards Branch showed increased activity over the previous year; in fact, 1959-60 was the most active year on record for this Branch.

The number of seed samples handled showed an increase of approximately 13 per cent. over the previous year; the number of agricultural chemicals for which applications for registration were received increased from 3,140 in 1958-59 to 3,331; and inspectional services for both agricultural standards and fruit and vegetables were particularly active.

The campaign aimed at the inspection of retail fruit and vegetable establishments which was instituted in the previous year was intensified. An intensification of inspection at Roma Street railhead of hay, chaff, and grain and other heavy produce submitted for auction resulted in action being taken to withhold considerable quantities of produce from the market until reconditioned. The inspection of agricultural chemicals was focused mainly on distributing centres rather than on manufacturing centres, as in the previous year. As a result, large quantities of unregistered and incorrectly labelled pesticides were located and seized.

Seed certification showed further general progress, particularly with respect to Sweet Sudan grass, where 83,532 lb. of seed were certified. This is by far the greatest quantity of this seed ever certified, which suggests that earlier problems in harvesting and cleaning of the seed have now been largely overcome.

Standards Branch officers contributed regularly to Departmental radio broadcasts and press releases, and in the compilation of lists of registered agricultural requirements for publication.

Comprehensive amendments to the *Fruit and Vegetable Grading and Packing Regulations* were made during the year.

SEED TESTING

The increase in the number of samples submitted for seed testing (see Table 1) was brought about by an intensification of the activities of Inspectors of the Branch on the quality of seeds offered for sale. This could also account for the decline in the number of samples received from merchants and farmers.

TABLE 1

SUMMARY OF SEED SAMPLES EXAMINED

Source of Samples	1958–59	1959–60
Inspectors of the Branch ..	1,904	2,962
Seed certification	332	283
Experimental projects	399	941
Submitted samples—		
(1) Merchants	6,364	5,830
(2) Farmers	360	171
(3) Government Departments	964	1,496
Total	10,323	11,683

The number of samples submitted by other Branches of the Department for testing during the year showed a considerable increase, from 964 to 1,496. Generally these samples related to experimental work being undertaken by the Branches concerned to determine the effect of seed treatments in the control of insect pests and diseases, and to check the methods of extraction and the storage capacity of seeds of citrus and papaw. Experimental projects conducted by the Standards Branch resulted in a considerable increase in the number of tests made for this purpose.

A storage trial of sorghum and French bean seed, commenced in September 1956, continued to show that in cold storage at a temperature of 40 deg. F. there has been no loss of viability, irrespective of whether the seed is stored in sealed drums, in polythene-lined bags, or in jute bags. The decline which appeared 12 months ago with sorghum seed stored under atmospheric conditions continued, and this seed now fails to comply with the prescribed minimum germination standard. This decline is common in all types of containers. Similarly, while French bean seed stored at 40 deg. F. has maintained viability at a high level, under atmospheric conditions in jute bags it commenced to decline in germination after 36 months' storage.

An innovation from the seed trade during the year was the introduction of "dry conditioned" seed to the market. This seed is dried to a predetermined moisture content and packed in moisture-resistant containers with a view to extending its storage life. Experiments are progressing to ascertain the efficacy of such containers.

SEED CERTIFICATION

Table 2 summarises the production of certified seed and compares such production in 1959 and in the two previous years.

The amount of hybrid maize seed certified during the 1958-59 season approximated the normal annual requirements. However, a large carryover of seed from the previous season resulted in a similar carryover to the 1959-60 season. The carryover seed was sampled to check germination and so safeguard the purchaser. The acreage registered for certified hybrid maize seed production in the 1959-60 season was severely curtailed, the aim being to produce only sufficient seed for normal annual requirements plus a carryover of up to 2,000 bus.

TABLE 2

PRODUCTION OF CERTIFIED SEED

Crop	1957		1958		1959	
	Certified	Refused	Certified	Refused	Certified	Refused
Hybrid Maize (bus.)	10,454	75	15,556	218	11,107	341
Grain Sorghum (bus.)	29,476	..	23,765	3,684	28,686	6,015
Sweet Sorghum (bus.)	552½	..	..	723	1,692	45
Sudan Grass (bus.)	401	429	..	4½	83,532*	1,350*
French Beans (bus.)	129½	28	387	93	371	28
Tomatoes (lb.) ..	621½	..	..	..	466	..
Buffel Grass (lb.)	..	..	2,476	1,568	..	..

* Lb.

The amount of certified grain sorghum seed produced in the 1958-59 season, though high, was below the amount expected. This was brought about, to a certain extent, by 6,015 bus. of seed being rejected due to the presence of prohibited weed seeds. Cleaning seed for certification during 1959 was, in a number of cases, difficult because of the presence of weed seeds. Excellent growing conditions favoured both crops and weeds and made weed control in the field difficult.

The early concern felt by some certified grain sorghum seed growers that sales of certified seed would be affected by the large amount available for sale and the relatively low price prevailing for sorghum grain proved unjustified. Sales of seed for the 1960 planting

were good and though there is a carryover of seed to the 1960-61 season, it is not nearly as large as was expected.

It is anticipated that yields of seed crops for certification yet to be harvested will be smaller than last year's due to poor growing conditions.

The amount of Sugardrip sweet sorghum seed certified was greater than in the two preceding years. However, seed of the Italian variety of sweet sorghum was rejected due to poor germination.

The quantity of Sweet Sudan grass seed certified was the greatest since the introduction of this crop to the certification scheme.

The amount of certified bean seed produced in 1958-59 was similar to the previous season. A second commercial seed firm was included in the certification scheme for bean seed. During the current season, two additional firms negotiated with growers to produce certified bean seed under contract. This is gratifying, as it speaks highly of the esteem in which Queensland certified bean seed and commercial seed produced from such seed is held.

Certification of tomato seed in the 1958-59 season amounted to 446 lb. Sales of this seed continue to be good.

No buffel grass seed was certified in 1958-59. This seed presents a number of problems in harvesting, particularly by mechanical means, to ensure both satisfactory cleanliness and germination.

REGISTRATION OF AGRICULTURAL REQUIREMENTS

During the year, applications for the registration, re-registration or extension of registration of 3,331 agricultural requirements were received, compared with 3,140 in the previous year.

The Agricultural Requirements Board, at 21 meetings, reported on the efficacy of 678 preparations, of which 443 were pest destroyers and 235 veterinary medicines. Of these, 28 pest destroyers and 2 veterinary medicines were refused registration on the recommendation of the Board.

All veterinary medicine preparations are being reviewed in 1960 as, at the beginning of February, a 3-year registration period for such preparations commenced. There is a trend towards the use of mixtures of vitamins, antibiotics, preventive medicines and minerals instead of the inclusion of these additives separately in poultry and stock feeds.

Fertilizer formulations were changed during the year owing to superphosphate being manufactured from a different grade of raw material. The phosphate rock used for this purpose is now obtained partly from Christmas Island instead of exclusively from Nauru Island. The superphosphate manufactured from this material contains the same total phosphoric acid (22 per cent. P_2O_5), but the water-soluble portion has been reduced from 20.5 to 19.0 per cent. phosphoric acid.

In recent years considerable attention has been given throughout Australia to the possibility of obtaining uniformity in registration, specification and labelling of veterinary medicines and pesticides. During the past year conferences were held in Canberra to discuss veterinary medicine registrations and in Sydney to consider uniform specifications and testing techniques for pesticides.

INSPECTION—AGRICULTURAL STANDARDS

This section showed a considerable increase in activity over previous years. Inspections were made in 146 towns, a total of 1,259 inspections being made with respect to sellers of agricultural requirements. The increase over the previous year can be accounted for by the fact that two Inspectors appointed during 1958-59 have now completed their training period and country districts have been more regularly visited.

Seeds

Table 3 indicates the action taken on unsatisfactory seeds. The reduction in the quantity of sub-standard seed found can be accounted for to a large extent by the success achieved from the vigorous campaign of last year.

TABLE 3

Action Taken on Unsatisfactory Seeds

—	1958-59	1959-60
Agricultural crop seeds cleaned under the supervision of an inspector	2,297 bags	632 bags
Destroyed or otherwise rendered unsuitable as seed—		
(i.) Agricultural crop seeds	73 bags	353 bags
(ii.) Vegetable seeds ..	12,981 lb.	1,176 lb.
(iii.) Packeted seeds ..	1,020 pkts.	2,437 pkts.
Processed for stock foods—		
(i.) Agricultural crop seeds	460 bags	475 bags
(ii.) Vegetable seeds ..	..	1 bag

Material Other than Seeds

Considerable emphasis was placed on the inspection of stock foods, particularly hay, chaff, and grain received for auction at Roma Street railhead. During the year, 6,041 consignments were inspected there, involving 120,938 bags of chaff, 234,564 trusses of hay, 23,819 bags of maize, and 13,715 packages of sundry materials.

Table 4 shows that while most of this material complied with prescribed standards, there was a proportion which was of inferior quality. Where possible, such material was cleaned or picked over and satisfactory material released. Considerable pressure was exerted during the year for the return to growers of sub-standard produce seized at Roma Street railhead. It was considered that to accede to such a request would have been a retrograde step, would not sufficiently penalise the seller of inferior materials, and would not give sufficient incentive to growers to produce a superior article.

TABLE 4

Summary of Action on Material Other than Seeds

—	1958-59						1959-60					
	Fertilizers	Lime	Pest Destroyers	Veterinary Medicines	Stock Foods	Total	Fertilizers	Lime	Pest Destroyers	Veterinary Medicines	Stock Foods	Total
Samples received from—												
Inspectors	84	5	209	29	354	681	69	11	77	4	400	561
Buyers	..	..	2	..	10	12	3	..	10	..	19	32
Seized	..	..	3,656 (*b*)	10 (*b*)	523 (*c*)	..	..	..	3,107 (*b*)	157 (*b*)	1,974 (*a*) 1,196 (*b*) 2,259 (*c*)	..
Reconditioned, relabelled or deficiency rectified	..	..	3,452 (*b*)	..	68 (*a*)	..	..	..	2,654 (*b*)	..	1,776 (*a*) 1,196 (*b*) 785 (*c*)	..
Destroyed	..	..	224 (*b*)	5 (*b*)	669 (*c*)	..	..	..	37 (*b*)	15 (*b*)	198 (*a*) 1,474 (*c*)	..
Withdrawn from sale ..	..	..	..	5 (*b*)	..	..	..	..	..	..	..	..

(*a*) Bags. (*b*) Packages, tins or bottles. (*c*) Trusses of hay.

During the year a prosecution was successfully launched against a manufacturer of poultry foods for failure of his preparations to comply with the prescribed standards.

Table 4 shows that 3,107 packages of pesticides were seized for failure to comply with the provisions of the Act. A considerable portion of this quantity consisted of so-called "special dusting mixtures" for use in tobacco and potato pest and disease control. These materials were not special mixtures in accordance with the definition contained in *The Agricultural Standards Act of* 1952, and appropriate action was taken to have them withdrawn from sale.

INSPECTION—FRUIT AND VEGETABLES

The inspection of fruit and vegetables was pursued with considerable vigour during the year. Routine inspection of retail establishments which was commenced in the previous year was intensified to the extent that 662 retailers were visited during the year, involving 1,943 actual inspection visits.

Comprehensive amendments to the *Fruit and Vegetable Grading and Packing Regulations* were gazetted to operate as from May 16, 1960. These Regulations consolidate a number of amendments that have been introduced since the previous gazettal in 1953. They provide for amended grade standards for potatoes, apples and pears, which will now be uniform throughout all States of the Commonwealth. This will overcome certain difficulties encountered in the previous Regulations and will facilitate interstate trading in these commodities.

Major changes were made in those Regulations relating to grade standards for onions, pumpkins, bananas, beans and rockmelons, and maturity standards for papaws, mangoes, and beans were re-defined.

A major innovation is the requirement for retailers of fruit and vegetables to indicate the grade of produce being offered for sale where a grade is prescribed.

New parts have been added to these Regulations prescribing the procedure for the disposal of faulty fruit and vegetables, inspection fees, and sampling techniques.

Table 5 contains figures relating to condemnation, reconditioning or regrading of fruit and vegetables, either locally produced or from interstate sources, offered for sale in Queensland.

Totals of 407,883 bags of potatoes, 71,926 bags of pumpkins and 128,877 bags of onions were inspected during the year. Approximately 5 per cent. of the potatoes, 7½ per cent. of the pumpkins and 13 per cent. of the onions were faulty. Undoubtedly, there is considerable room for improvement in the qualtity or the grading of produce being offered for sale.

IMPORTS AND EXPORTS

Imports of seeds were generally slightly down on figures for the previous year, mainly due to a reduction in the quantity of velvet bean seed imported. This was due to adverse weather conditions and a relatively poor harvest of these seeds in South Africa.

It was decided during the year that all consignments of Centrosema seed being imported would be channelled through the port of Brisbane, and Commonwealth legislation was introduced to implement this. This was due to the possible presence of seed of *Mimosa invisa* (giant sensitive plant) in this tropical legume. The decision to direct this seed through Brisbane was influenced largely by efficiency of the sampling and testing facilities provided by the Standards Branch. It is worthy of note that all but one of the consignments of Centrosema seed so imported contained prohibited matter, mostly *Mimosa invisa* seed.

The United Kingdom, Japanese and Continental markets again imported large quantities of grains from Queensland sources, mainly wheat, barley, white French millet and canary seed. A profitable market for *Paspalum dilatatum* in the U.S.A. continued during the year and over 200 tons were exported to this destination. Certificates showing results of analyses were issued with respect to these consignments.

TABLE 5

SUMMARY OF ACTION TAKEN ON UNSATISFACTORY FRUIT AND VEGETABLES

Fruit				Vegetables			
Class	Condemned Packages	Reconditioned or Regraded Packages	Total	Class	Condemned Packages	Reconditioned or Regraded Packages	Total
Apples	5,714	4,008	9,722	Artichokes	4	..	4
Apricots	877	5	882	Beans	5,026	..	5,206
Avocadoes	27	..	27	Beetroot	282	112	394
Bananas	891	739	1,630		257 (*a*)	..	257 (*a*)
	1,066 (*c*)	..	1,066 (*c*)	Broccoli	8 (*a*)	..	8 (*a*)
Cherries	359	..	359	Brussels Sprouts	132	..	132
Coconuts	52	..	52	Cabbage	69	..	69
	2 (*b*)	..	2 (*b*)		110 (*a*)	..	110 (*a*)
Custard Apples	11	..	11		1,154 (*b*)	..	1,154 (*b*)
Figs	9	..	9	Capsicums	801	..	801
Gooseberries	9	..	9	Carrots	635	200	835
Grapes	220	16	236	Cauliflowers	2	..	2
Grapefruit	130	45	175		172 (*b*)	..	172 (*b*)
Lemons	1,639	302	1,941	Celery	60	..	60
Mandarins	589	595	1,184		164 (*a*)	..	164 (*a*)
Mangoes	403	2	405	Chokos	570	..	570
Nectarines	233	12	245	Corn	23	5	28
Oranges	918	2,714	3,632	Cucumbers	3,001	127	3,128
Papaws	1,274	14	1,288	Egg Fruit	194	..	194
Passion-fruit	91	72	163	Eschallots	183	..	183
Peaches	1,844	58	1,902	Garlic	92	137	229
Pears	1,663	455	2,118	Lettuce	337	..	337
Pineapples	530	139	669	Marrows	99	11	110
	812 (*b*)	..	812 (*b*)	Mint	5	..	5
Plums	1,021	255	1,276		8 (*a*)	..	8 (*a*)
Rockmelons	1,378	252	1,630	Mushroom	1	..	1
	4 (*b*)	..	4 (*b*)	Onions	7,441	9,794	17,235
Rosellas	17	..	17	Parsley	5	..	5
Strawberries	103	..	103		177 (*a*)	..	177 (*a*)
Tomatoes	5,067	2,770	7,837	Parsnips	259	1	260
Watermelons	336 (*b*)	..	336 (*b*)	Peas	265	130	395
	669 (*c*)	..	669 (*c*)	Potatoes	3,546	18,311	21,857
	175	..	175	Pumpkins	709	4,766	5,475
				Radish	201	..	201
				Rhubarb	451	..	451
				Spinach	143	..	143
				Squash	23	..	23
				Sweet Potatoes	471	59	530
				Swede Turnips	306	..	306
				Turnips	343	29	372
					296 (*a*)	..	296 (*a*)

(*a*) Bunches. (*b*) Dozen. (*c*) Lb.

TABLE 6

IMPORTS—SEED FOR SOWING

Agricultural Seeds—		Bags
Centrosema		218
Clover		105
Mangel		13
Rape		233
Miscellaneous (Bird Seed)		9
		578
Grass Seeds—		Bags
Bent		10
Buffel		23
Kleberg Blue Stem		9
Setaria sphacelata	8 lb.	
	8 lb.	42
Velvet Beans		4,578 bags
Vegetable Seeds—		lb.
Beans		67
Beet		397
Cabbage		76
Carrot		158
Cauliflower		12
Cucumber		318
Herbs		5
Kale		96
Lettuce		41
Marrow		62
Melons, Water		150
Melons, Rock		78
Mustard		336
Onion		6
Pumpkin		3
Radish		23
Rhubarb		4
Swedes		231
Sweet Corn		28
Turnip		7
Miscellaneous		23
		2,121
Peas		375 bags

Inspections of fruit and vegetables exported from Queensland were conducted before loading and necessary certificates issued with respect to their condition.

TABLE 7

EXPORTS—GRAINS AND SEEDS

Barley	84,089	bags
Bean	595	lb.
Birdwood Grass	78	lb.
Blue Panic	20	lb.
Broom Millet	51	lb.
Buffel Grass	664	lb.
Canary	52,964	bags
Carpet Grass	9½	tons
Centrosema	1,098	lb.
Cotton	6	tons
Cowpea	155¼	tons
Green Panic	7,456	lb.
Guinea Grass	649	lb.
Japanese Millet	5,289	bags
plus	181¼	tons in bulk
Lucerne	4	lb.
Maize	4,119	lb.
Molasses	1,063	lb.
Paspalum	210½	ton
Phalaris	50	lb.
Prairie Grass	14,056	lb.
Pueraria	3	lb.
Rhodes Grass	22	tons
Setaria italica	29,096	bags
Sorghum	3	tons
Soybean	56	lb.
Sunflower	3,529	bags
Velvet Bean	304	lb.
Townsville Lucerne	313	lb.
Wheat	118,459	bags
White French Millet	187,430	bags
Mixed Agricultural Seed	27½	lb.
Mixed Vegetable Seed	370½	lb.

It is noted that a record shipment of apples mainly to the United Kingdom took place. As a result of this, the total quantity of fruit and vegetables exported rose from 46,135 packages in 1958-59 to 152,088 packages during the current year.

Imports of fruit and vegetables, mainly from other States of the Commonwealth, were inspected on arrival at place of discharge in Queensland.

TABLE 8

QUEENSLAND EXPORTS—FRUIT AND VEGETABLES

Apples	127,865	cases
Apricots	3	,,
Bananas	6	,,
Cherries	6	,,
Custard Apples	2	,,
Grapefruit	135	,,
Grapes	16	,,
Lemons	70	,,
Mandarins	398	,,
Oranges	9,865	,,
Peaches	8	,,
Pears	1,584	,,
Pineapples	817	,,
Plums	6	,,
Tomatoes	946	,,
Beans	24	bags
	16	cases
Beetroot	3	bags
Capsicums	25	bags
Cabbage	258	bags
	74	cases
Carrots	333	bags
	82	cases
Cauliflower	15	bags
	93	cases
Celery	107	cases
Cucumber	51	cases
Garlic	4	bags
	158	cases
Lettuce	3	cases
Onions	2,897	bags
	850	cases
Parsnips	59	bags
	8	cases
Peas	11	bags
	4	cases
Potatoes	1,978	bags
	3,025	crates
	6	bags
Pumpkin	217	bags
Rhubarb	19	cases
Swedes	41	bags
Total	152,088	packages

THE FARM PRODUCE AGENTS ACTS

The administration of *The Farm Produce Agents Acts, 1917 to 1952* was placed under the control of the Standards Branch in August, 1959. The primary objects of this Act are to ensure that agents correctly account for consignments of farm produce forwarded for sale on the producer's or owner's behalf and to prevent fraudulent misapplication of monies received for the sale of such produce held in trust pending payment.

During the year routine inspections of agents' books of account and other records revealed that all agents visited were adhering to the provisions of the Acts and accounting for consignments received in the correct manner. Any irregularities noticed were readily rectified. Several complaints by growers were also investigated.

There are 117 licenced Farm Produce Agents in Queensland and of these 70 are in the Brisbane area. Country agents are situated in 22 different centres throughout the State. Continuous endeavours have been made to trace unlicenced Agents.

CLERICAL AND GENERAL DIVISION

The need for additional clerical assistance is, of course, a natural corollary to the Department's expansion in the technical field and in this connection it is pleasing to note that there has been an increase in the number of clerical staff during the year. This improvement has succeeded in relieving specialist officers of a good deal of routine office work and enabled them to devote more time to their primary duties. In the overall picture 6 more clerks and 3 clerk-typistes are required for Head Office and 2 clerks and 6 clerk-typistes for country offices.

The staff of the Department at 30th June, 1960, totalled 1,396. The Clerical staff numbered 249, as shown below:

——	Brisbane	Country	Total
Clerks	97	3	100
Clerk-Typistes ..	77	60	137
Male Assistants ..	7	1	8
Female Assistants ..	3	1	4
Total ..	184	65	249

RECORDS

The amount of correspondence handled by the Records Branch created another record, as shown by the following figures for mail registrations:

——	Inward	Intramural	Outward	Total
1957–58	85,552	10,453	54,140	150,145
1958–59	88,345	10,035	54,581	152,961
1959–60	90,326	12,492	55,930	158,748

This table does not include the thousands of application forms, returns, etc. which are handled and sorted.

The appointment of an Assistant to the Record Clerk has improved the staff position. His duties include the relieving of six registration officers when these are absent on leave. His appointment has eliminated overtime and overcome the delay in registration of mail.

ACCOMMODATION

The Head Office building of the Department is presently being renovated and painted by the Department of Public Works. It is some 40 years since this was last done and the contrast between the newly renovated sections and those still to be done is most marked. The pleasant working conditions now existing are beneficial to the morale of the staff. However, the problem of space is still acute. As new appointments are made, it is necessary to find room for them in offices already crowded.

Accommodation in the country is showing rapid improvement. First class office buildings have been provided at many country centres and improvement is occurring or is planned for other towns.

Additions to the Court House at Beenleigh have been completed. Officers who formerly occupied leased premises are now located there.

Extensions to the buildings at Emerald and Nambour have been completed and are now occupied. Officers at Winton are now accommodated in the new Court House Building.

Office accommodation will be provided for this Department in the new Court House Building at Mount Isa which is at present in the course of construction.

Departmental Officers at Blackall are now occupying rented premises pending the completion of a new Court House Building.

Consideration is being given to the provision of additional laboratory accommodation at Malanda. A building has been reserved at Tinaroo Falls for removal to Malanda.

Additional accommodation will be provided at Longreach in the remodelled Court House.

Plans have been prepared for extensions to the office at Gympie, where the present accommodation is overtaxed.

Consideration is being given to the provision of additional accommodation at Crow's Nest and Oakey.

Extensions have been obtained to leases of premises at Cairns and Southport. The lease of premises at Wowan expired but the tenancy is being continued on a weekly basis.

At Kingaroy, the existing accommodation is inadequate. In addition to several offices in the Court House building, the Department leases three rooms in a private building. Negotiations are in train to obtain a lease of the whole building to provide additional accommodation.

HOUSING

Where officers in country districts are unable to obtain suitable houses for rental, a Government house is provided where possible either by the purchase of an existing house or by the erection of a new building by the Department of Public Works. During the year, three additional officers were provided with houses. Approval has also been given for the erection of one house and the purchase of two others, while consideration is being given to the purchase of an additional three.

ACCOUNTS

The total expenditure and receipts of the Department for the year 1959-60, compared with 1958-59, are as follows:—

——	Expenditure		Receipts	
	1958–59	1959–60	1958–59	1959–60
	£	£	£	£
Consolidated Revenue	1,207,856	1,400,884	170,614	223,911
Trust and Special Funds (includes Sugar Bulk Handling Facilities Expenditure £979,996 and £740,450, Receipts £1,002,082 and £891,058)	2,102,670	1,834,490	2,133,655	1,959,534
Schedule B	3,702	3,702	..	..
Schedule C—				
Stock Fund	210,980	204,924	..	..
Banana Industry Fund	4,705	5,592	..	..
Total	3,529,913	3,449,592	2,304,269	2,183,445

Further statistical figures are detailed below:—

	1958-59	1959-60
Receipts issued	21444	21672
Vouchers paid	36571	37242
Cheques issued	53216	53189
Income earning certificates issued	1950	2002

TRANSPORT

During the year, 60 new vehicles were purchased; of these, 46 were replacements for vehicles which had been condemned, 4 replaced privately owned vehicles which were no longer available for Departmental use, and 10 were additions to the fleet. Eleven of the new vehicles were purchased from funds provided by the Commonwealth—5 from Commonwealth Extension Services Grant, 3 from the Commonwealth Dairy Industry Extension Grant and 3 from the Tobacco Research Fund.

A total of 56 vehicles was disposed of during the year. The Departmental fleet now numbers 313 vehicles.

Two hundred and fifty-nine officers use their privately owned vehicles for official purposes on a mileage basis.

EXTENSION SERVICES

Induction training in extension methods was given to officers of the Veterinary Services Branch who attended a fortnight's induction course at Head Office. Sessions on extension were also provided during refresher courses for officers of the Cattle Husbandry Branch and the Poultry Section.

Two 12-day in-service schools in extension methods were held during the year. Over 60 Departmental officers attended. They were drawn not only from the extension staff but also from supervisory and scientific officers concerned in transmitting information to farmers. By special arrangements, extension personnel from Fiji and Ceylon also attended.

Four Colombo Plan Fellows from the Borneo region, who were concerned with public administration, visited the Department to learn something of its operations in extension.

The extension co-ordination staff was consulted on numerous matters during the year. These included film production; design of displays and leaflets; design, content and analysis of questionnaires; conduct of field days; and special photographic techniques. The illustrator attached to the staff was engaged on art work for publications and other extension media.

The central tape recording service was further expanded and 17 radio stations are now supplied regularly with taped talks by Departmental officers. The digest form of tape was continued, as this seems to be the most suitable both for stations and for listeners.

At the request of the Division of Plant Industry, the Extension Training and Research Officer examined the functioning of the Division's tobacco extension services in the Burdekin area and made recommendations for change. This officer also continued a survey of the training needs of Departmental extension officers in general.

LIBRARY AND ABSTRACTING SERVICE

The Central Library was conducted during the year by staff of the Public Library of Queensland. This arrangement resulted in a satisfactory staffing situation and the needs of officers generally have been adequately met. The library has the Department's main holdings of periodicals and pamphlets and operates an extensive lending service for Departmental officers.

A scientific abstracting service was provided by the Information Branch, the Abstractor perusing all literature accessions and abstracting relevant items. This service has been widely used by all Branches.

PHOTOGRAPHIC SECTION

The volume of photographic work undertaken during the year was about the same as in the previous year, the output of prints being some 21,000. In addition, a large number of slides, both in colour and in black and white, were made. Most of the photographic work emanated from field officers equipped with cameras, but the photographic staff made a number of field trips for specific purposes.

The acquisition of new equipment and the development of new techniques during the year allowed the Section to undertake specialised work that could not be done previously.

The Central Film Library of motion pictures was added to. The library was drawn upon by numerous field officers for extension purposes. A large number of films were secured and screened for appraisal by Departmental officers.

Motion picture production during the year was of two types—extension and public relations. A film depicting unsatisfactory cultural practices in cotton growing was shot, and progress was made with a technical film on beef cattle pastures. On the public relations side, arrangements were made for the use of films on television and a number of short films depicting various activities of the Department were put in hand. The subjects included seed testing, fauna conservation and school packing classes.

PUBLICATIONS

The circulation of the *Queensland Agricultural Journal* continued to grow. This upward trend was accelerated by the new format which the Journal assumed with the January 1960 issue. The new Journal is slightly larger in dimensions, embraces the use of photographic colour, makes more effective use of a larger type, and presents information in a more readily assimilated form. It has had the immediate result of showing an increased rate of new subscriptions as well as an increased rate of renewal of subscriptions.

The publicity campaign directed towards increasing subscribers to the Journal has been placed on a steady basis. The main media are the display racks at 12 country centres, a monthly radio preview of the Journal articles, and a regular supply of similar preview material to country newspapers.

During the year, 109 articles that appeared in the Journal were reprinted and issued as advisory leaflets. These originated from: Division of Plant Industry, 48; Division of Animal Industry, 48; Division of Dairying, 10; and Division of Marketing, 3. The number of copies of reprinted articles amounted to 144,000.

Corrected proofs of Volume II. (Horticulture) of the *Queensland Agricultural and Pastoral Handbook* series are still in the hands of the Government Printer, and no progress with this publication was possible in the past year. The complete manuscript of Volume I. (Farm Crops and Pastures) has been prepared.

During the year, the name of the Department's weekly News Bulletin was changed to Press Release. This brings the title of the service into line with its aim—giving advice and explanations to primary producers on topical problems. The Press Release, which contains three items in each weekly issue, is sent to about 100 newspapers and radio stations, mainly in Queensland. The provincial press has used this material regularly, and it is given prominent display treatment, especially in those dailies publishing a weekly "farmer's page". Summaries of the items have been widely circulated over Australian Broadcasting Commission Stations.

The service supplying special feature articles to selected newspapers was expanded last year. It has been found that these articles can be placed more frequently than the quarterly intervals of the previous year. At present these are being supplied and published at the rate of one every four to six weeks. From the response, it was clear that photographs accompanying these feature articles have a special appeal. Often they serve to "sell" the article to editors.

The Information Branch and Agriculture Branch co-operated to prepare a series of special advisory articles on tobacco growing. This series was published by newspapers serving tobacco growing districts.

News reports covering current activities of the Department were released almost every day to the

press and radio stations. As in the instances of the press releases and feature articles, these statements were given space in provincial newspapers, while metropolitan newspapers, too, gave them prominence in most cases.

COMMONWEALTH GRANTS

Commonwealth Extension Services Grant

This Grant has been renewed for a further period of five years from July 1, 1960. Queensland's annual share of the Grant is £57,000. As the name of the Grant implies, it is intended primarily to assist the State's extension activities but investigational work which is of a marginal nature may also be approved. Projects being carried on with the aid of Grant funds include a campaign to minimise losses of cattle from contagious pleuropneumonia by extension work in endemic areas, supplementary feeding demonstrations with beef cattle, fat lamb production in coastal districts, litter recording of pigs and demonstrations of improved methods of rearing litters, a poultry improvement plan, and demonstrations of modern systems of economical egg production. The Agriculture Branch has a number of projects in different districts associated with cropping, improved pastures, use of fertilizers, weed control, and demonstrations of contour ditches and the stabilisation of gully waterways. The Grant also provides funds for a student scholarship in Agricultural Science and for the holding of two schools annually for extension officers. A motion picture film unit has also been established to produce pictures for extension purposes.

Dairy Industry Extension Grant

This Grant, which has been approved until June 30, 1963, contributes £65,800 annually as Queensland's share for the conduct of an approved programme of work to aid the dairy industry. Twenty-five per cent. of the cost of group herd recording is chargeable to the Grant, amounting to £21,225 annually.

More than 100 demonstrations with irrigated and rain-grown pastures are being conducted. An infertility survey in dairying districts is also being carried out. The proving of dairy bulls for artificial breeding purposes is another big project for which funds are provided. Dairy hygiene and milk and cream quality demonstrations and farm and herd surveys are features of the Grant involving the expenditure of considerable funds.

By Authority: S. G. Reid, Government Printer, Brisbane